# AN EVALUATION OF THE EFFICACY OF ADDING CLONIDINE AS ADJUVANT TO BUPIVACAINE AS COMPARED TO DEXMEDETOMIDINE AS ADJUVANT TO BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKS FOR UPPER LIMB SURGERIES

Dissertation submitted to

**THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY**

*In partial fulfillment for the award of the degree of*

**DOCTOR OF MEDICINE**

IN

**ANAESTHESIOLOGY**

**BRANCH X**

**DEPARTMENT OF ANAESTHESIOLOGY**

**THANJAVUR MEDICAL COLLEGE**

**THANJAVUR – 613004.**

**APRIL 2015**

# CERTIFICATE

This is to certify that the dissertation entitled, **"EFFICACY OF ADDING CLONIDINE AS ADJUVANT TO BUPIVACAINE AS COMPARED TO DEXMEDITOMIDINE AS ADJUVANT TO BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKS FOR UPPER LIMB SURGERIES"** submitted by **Dr.V.SARAVANAGOPI** in partial fulfillment for the award of the degree of **Doctor of Medicine in Anaesthesiology** by the Tamilnadu Dr.M.G.R. Medical University, Chennai is a bonafide record of the work done by him in the Department of Anaesthesiology, Government Thanjavur Medical College, during the academic year 2012-2015.

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## DECLARATION

I, **DR.V.SARAVANAGOPI**, solemnly declare that the dissertation titled **"EFFICACY OF ADDING CLONIDINE AS ADJUVANT TO BUPIVACAINE AS COMPARED TO DEXMEDITOMIDINE AS ADJUVANT TO BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKS FOR UPPER LIMB SURGERIES"** is a bonafide work done by me at Thanjavur Medical College Hospital, Thanjavur, during 2012-2015.

The dissertation is submitted to **"The Tamilnadu Dr. M.G.R. Medical University, Chennai",** Tamilnadu as a partial fulfillment for the requirement of **M.D** Degree examinations – Branch -X (Anaesthesiology) to be held in April 2015.

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EFFICACY OF CLONIDINE ADDED TO BUPIVACAINE AS COMPARED WITH DEXMEDITOMDINE ADDED TO BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

submitted by Dr. V. SARAVANAGOPI of

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was approved by the Ethical Committee.

Thanjavur

Dated : 19.9.2014

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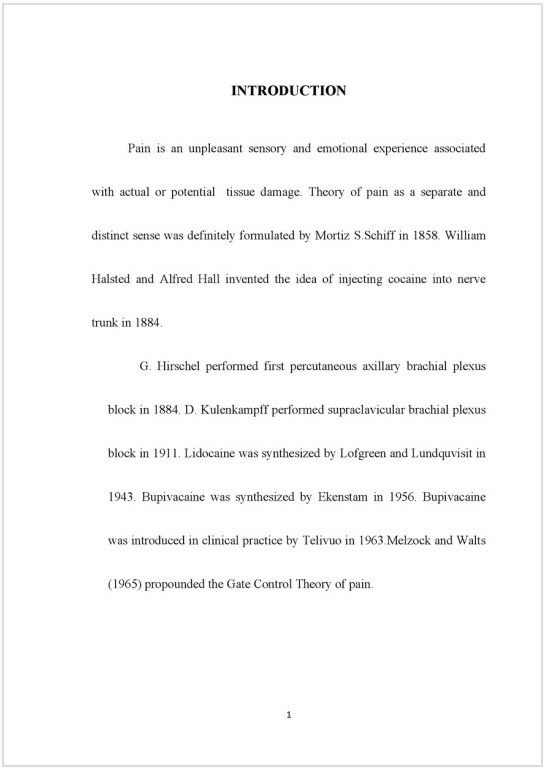

**INTRODUCTION**

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Theory of pain as a separate and distinct sense was definitely formulated by Mortiz S.Schiff in 1858. William Halsted and Alfred Hall invented the idea of injecting cocaine into nerve trunk in 1884.

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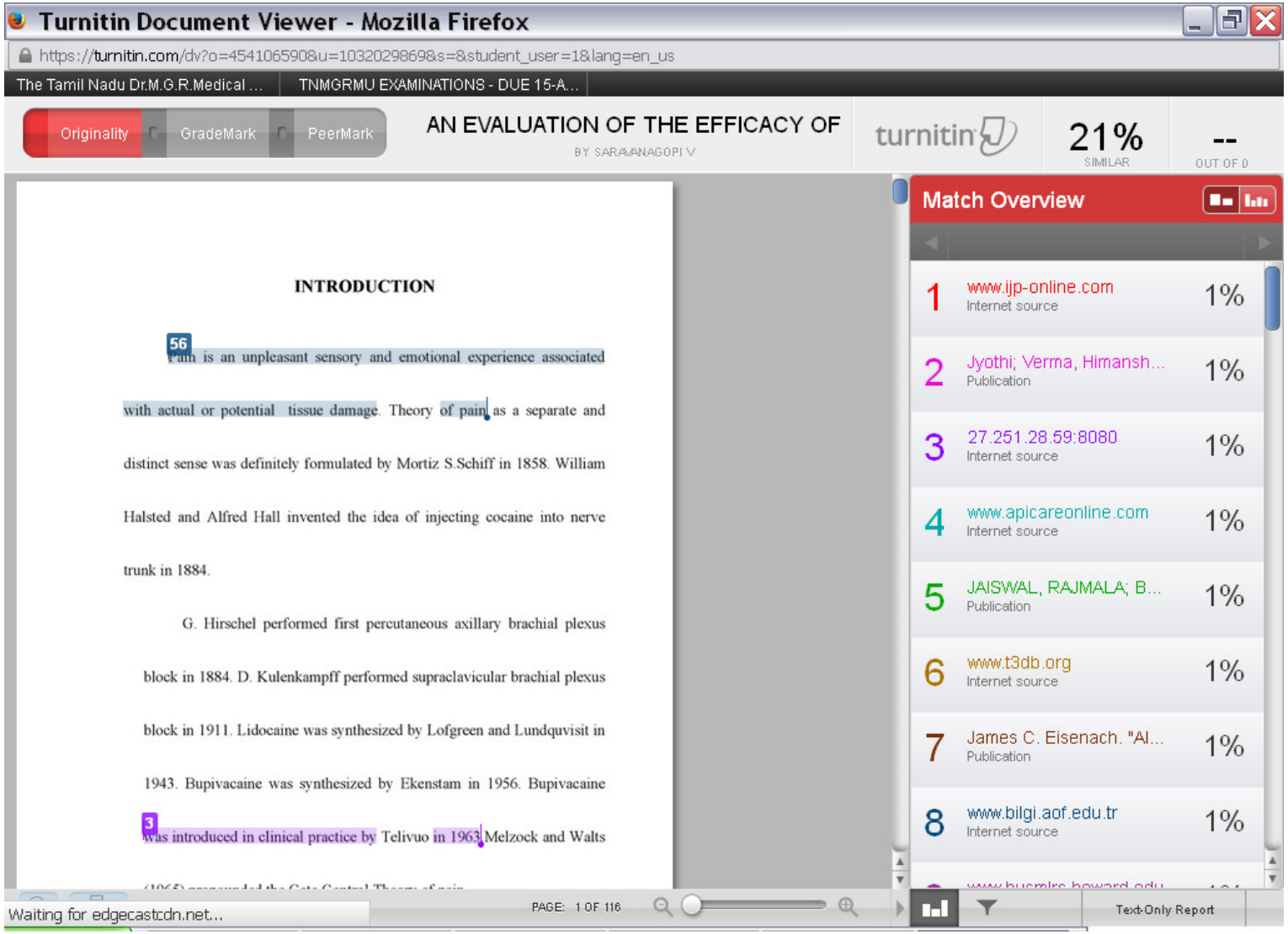
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## ABSTRACT

**Background and Objectives:** Alpha-2 agonists are mixed with local anaesthetic agents to extend the duration of spinal, extradural and peripheral nerve blocks. We compared clonidine and dexmedetomidine as an adjuvant to local anaesthetic agent in supraclavicular brachial plexus block with respect to onset and duration of sensory and motor block and duration of analgesia.

**Methods:** Sixty ASA I and II patients scheduled for elective upper limb surgeries under supraclavicular brachial plexus block were divided into two equal groups in a randomized, double- blinded fashion. Group C received clonidine 1 μg/kg and Group D received dexmedetomidine 1 μg/kg added to bupivacaine 0.25% (40ml). Onset and recovery time of sensory and motor block and duration of analgesia were studied in both the groups.

**Results:** Duration of sensory block and motor block was 224.50±32.70 and 307.70±34.91min, respectively, in group C, while it was 414.63±70.35 and 489.16±72.80 min, respectively, in group D. There was no statistically significant difference in onset of sensory block. Onset of motor block in group C was 5.66 ±1.39 minutes .Onset of motor block in group D was 5.40±1.88 minutes. Onset of motor block in group D is faster than group D; this difference was statistically significant. 'p' value < 0.005. The duration of analgesia (time to requirement of rescue analgesia) in group D was 455.96±71.34 min, while in

group C, it was 263.10±40.53 min. Statistically, this difference was significant (P=0.001).

**Conclusion:**

We conclude that addition of 1 µg/kg of dexmedetomidine to 0.25 % bupivacaine accelerates the onset of sensory and motor block, prolongs the duration of sensory and motor block and the time for rescue analgesia with mild sedation without any adverse effects, when compared to clonidine as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries

Key words: Clonidine, dexmedetomidine, supraclavicular block

# INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Theory of pain as a separate and distinct sense was definitely formulated by Mortiz S.Schiff in 1858. William Halsted and Alfred Hall invented the idea of injecting cocaine into nerve trunk in 1884.

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Peripheral nerve blocks provide optimal operating conditions when used ideally. They reduce the stress response to surgery and cause least interference with the vital physiological functions of the body,when compared to other conventional techniques. Brachial plexus block was first performed by William Stewart Halsted in 1889[1]. D. Kulenkampff performed supraclavicular brachial plexus block in1911. The main drawback of local anaesthetic agents are the delayed onset of action, varying intensity of blockade and inadequate post operative pain relief . To overcome these drawbacks, various adjuvants were added with local anesthetic solutions. Various opioid and non-opioid agents have been studied as adjuvants to Brachial Plexus blockade. Clonidine and Dexmedetomidine have shown greater affinity for α2 receptors.

“The aim of this study is to compare the relative efficacy of Clonidine and Dexmedetomidine with Bupivacaine for intra-operative/ post-operative analgesia and safety.Addition of alpha 2 adrenergic agonist drugs is suggested to improve the local anaesthetic effects by facilitation of C fiber blockade and local vasoconstriction or a simple diffusion along the nerve or slow retrograde axonal transport in spinal cord.

Clonidine and dexmedetomidine possibly amplify the Na+ channel blockade action of local anaesthetic by opening up the K+ channels resulting in membrane hyperpolarisation. This study compares clonidine and dexmedetomidine as an adjuvant to bupivacaine for brachial plexus block by supraclavicular approach for orthopaedic procedures of moderate duration using nerve stimulator . The Brachial Plexus is blocked at its most compact site (middle of Brachial Plexus) and it results in a homogenous spread of anaesthetic drug to cause early and complete block.

In clinical studies, adding clonidine or dexmedetomidine to local anaesthetic solutions improved peripheral nerve blocks by quickening the onset time, improving the quality of block during surgery and extending post operative analgesia.

## AIM OF THE STUDY

To evaluate the efficacy of adding Clonidine as an adjuvant to Bupivacaine as compared to Dexmedetomidine as adjuvant to Bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries, with regards to the following parameters:

a) Onset of sensory block

b) Duration of sensory block

c) Onset of motor block

d) Duration of motor block

e) Haemodynamic changes(heart rate,NIBP,SPO2)

f) Level of sedation and complications(if any)

# APPLIED PHYSIOLOGY

## PHYSIOLOGICAL CONSIDERATION

Painful stimuli is transformed from its native form by activated nociceptors into electrical signals which are transmitted along corresponding nociceptive fibres. These fibres in turn synapse onto II order neurons in the spinal cord. These interneurons are located in dorsal horn. At these interneurons ,the initial modulation of nociceptive input occurs. From the spinal cord, nociceptive input is transmitted to the brain stem, thalamus and cortex.

## Peripheral neuroanatomy of nociception:

A and C fibres are the main peripheral nociceptors. The skin, joints and periosteum are richly innervated with A and C nociceptors as well as the non nociecptive A and B sensory fibres.

The A fibres are responsible for sensation of first pain, the initial sharp pain experienced following an injury. The C fibres are unmyelinated and are responsible for second pain, the slow throbbing burning pain experienced following an injury.

**Peripheral neurochemistry and neurotransmitters :**

Inflammatory mediators involved in pain and hyperalgesia include potassium, substance P, Bradykinins, cytokines, serotonin, histamine and prostaglandins. These peripheral neurotransmitters sensitise the peripheral nociceptors to pain.

**Peripheral alpha 2 receptors :**

Alpha 2 adrenoreceptors ,located on primary afferent terminals, are on neurons in the superficial laminae of the spinal cord, and within several brainstem nuclei involved in analgesia, supporting the possibility of analgesic action at peripheral, spinal, and brainstem sites.

Clonidine increases both sensory and motor blockade from peripheral nerve injection and epidural / spinal injection of local anaesthetics.

Clonidine blocks conduction of A gamma and C fibers and increase K+ conductance in isolated neurons and increases conduction block of local anaesthetics.Local vasoconstriction resulting in reduced absorption from the injection site is another point of discussion. But compared with adrenaline as adjuvant, it failed to influence plasma levels.This indicates a direct action on nerve.

**PAIN PATHWAY**

**SPINAL CORD**

The gray matter of the spinal cord is divided into 10 lamina[2]. Lamina I – IV representing the dorsal horn. Dorsal horn is capped by the Lissauer's tract which consists of branches of cutaneous C and A fibres and few visceral afferents.

Nociceptive fibres ends in superficial layers of lamina I & II, while the non-painful myelinated fibres ends in the deeper layers of lamina III,IV . Lamina II has highest concentration of opioid receptors in the spinal cord.

Modulation and inhibition of nociception occurs at this level, by the use of opioids (systemic and neuraxial).

**Ascending sensory pathways**

Peripheral sensory neurons synapse with the secondary interneurons of dorsal horn.Axons of non nociceptive secondary neurons travel bilaterally in the dorsal columns of the spinal cord as fasciculus cuneatus and fasciculus gracilis and synapse in thalamus.

The axons of nociceptive secondary neurons, after synapsing, travel contralaterally in anterolateral aspects of spinal cord as neospinothalamic and paleospinothalamic tracts.

Neospinothalamic tract carries fine discrimination of pain eg. First pain, Intensity and location.

The paleospinothalamic tract synapses in the thalamus, hypothalamus and limbic system and plays a role in emotional aspects of pain via limbic system. Paleospinothalamic tract responds to noxiousstimuli.The thalamus has multiple connections to limbic system and cortex.

**Descending inhibitory pathways**

The descending tracts of pain end in the laminas I, II, V of dorsal horn from mesencephalon, raphenuclei and reticular tract. The mesencephalon is rich in opioid receptors. This area sends excitatory transmissions to the rostroventral medulla which sends noradrenaline and serotonin inhibitory tracts via the dorsolateral funiculus to lamina I,II,V of spinal cord.

The noradrenaline and serotonin fibres mediate transmission between primary afferents and secondary neurons of the dorsal horn. Enhanced activity of these fibres leads to enhanced inhibition of pain transmission.

**Location of Alpha2 receptors :**

Alpha 2 receptors are located in the primary afferent terminals, on neurons in the superficial laminae of spinal cord and the brainstem nuclei.

**Location of opioid receptors (central):**

Opioid receptors are found in cerebral cortex, limbic cortex ,anterior and posterior amygdalae, hippocampus,hypothalamus, medial thalamus, mid brain, periaqueductal gray matter, extrapyramidal areas, substantia gelatinosa and sympathetic preganglionic neurons.

Opioid receptors are also found in cardiac sympathetic fibres, cardiac branches of vagus, adrenal medulla, and in the gastro intestinal tract

**ACTION OF LOCAL ANAESTHETICS ON NERVE FIBRES[3]**

The primary action of local anaesthetics on nerve is electrical stabilization. Large transient increase in Na+ ion permaeability essential for nerve impulse propagation is prevented.The resting membrane potential is maintained and depolarization is inhibited in response to stimulation.

Local anaesthetics block sodium conductance as follows:

a) Binding of local anaesthetics to voltage gated Na+ channels prevents its opening by inhibiting conformational changes that underlie activation of the channel.

b) Local anaesthetics also produce nonspecific expansion of the membrane.unfolding of the membrane protein together with disordering of lipid componenet of cell membrane causes obstruction of Na+ channel.

**ACTION OF ALPHA ADRENERGIC AGONISTS**

a) Alpha adreno receptors are located on the afferent terminals of peripheral neurons ,neurons in superficial laminae of spinal cord and many brainstem nuclei involved in analgesia.

b) Dexmedetomine and clonidine inhibits voltage gated sodium and potassium channels & suppress the action potential generation in tonic firing neurons.

c) Release of acetyl choline in the neuraxial region and blocking of C fibres in the peripheral nerves may contribute to pain relief.

## ANATOMICAL CONSIDERATIONS

## FORMATION OF BRACHIAL PLEXUS[4]

### Roots

The plexus is formed by anterior primary rami of the fifth to eighth cervical nerves, together with the bulk of the 1st thoracic nerve (C -8 and T1). There is frequently a contribution above from C4 to the 5th cervical root and another below from T2 to the 1st thoracic nerve. Occasionally the plexus is mainly derived from C4 -8 (Pre –fixed plexus) or from C6 – T2 (post – fixed plexus).

### Trunks

The five roots of plexus emerge from intervertebral foramina. They lie in the space between anterior and posterior tubercles of the corresponding transverse processes. All 5 roots, lie between the scalenus anterior and medius. Here roots of C5 &C6 unite into the upper trunk. The root of C7 continues as the middle trunk and those of C8 and T1 into the lower trunk. Then each of these trunks divides behind the clavicle, into anterior and posterior divisions, which unite in axilla to form the cords.

**Cords**

The six divisions stream into axilla and form three cords, lateral, medial and posterior. These cords are composed as follows:

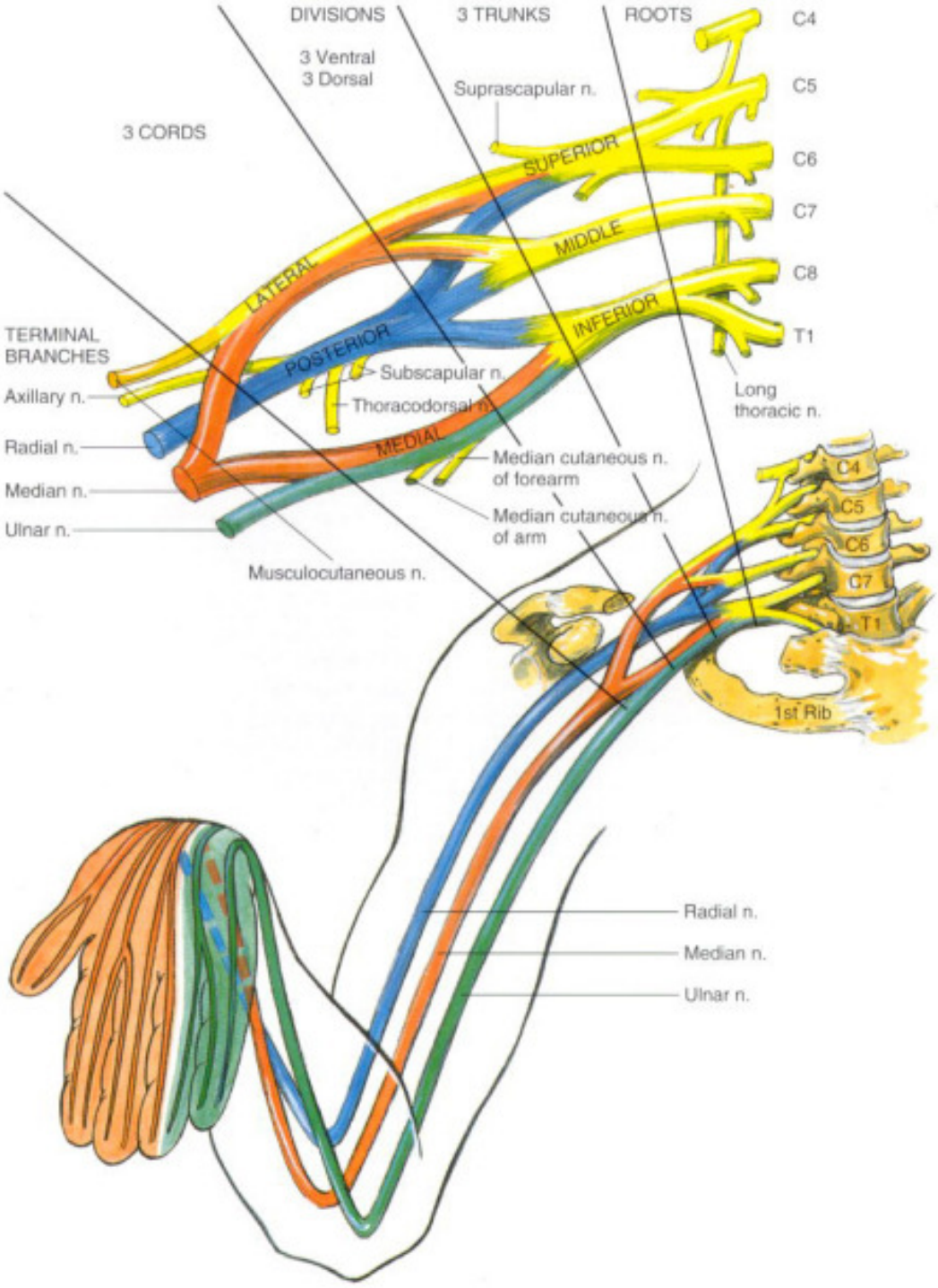
The union of the anterior divisions of upper and middle trunks forms the lateral cord. The continuation of the anterior division of the lower trunks represents the medial cord. The posterior cord comprises of all three posterior divisions.

The composition of the brachial plexus can be summarized as follows:

1. Five roots – the anterior primary rami of C5 to C8& T1
2. Three trunks.
    a) Upper trunk, C5 & C6
    b) Middle trunk, C7 alone &
    c) Lower trunk, C8 &T1
3. Six division – each trunk divides into anterior and posterior division.
4. Three cords
    a)Lateral cord, the fused anterior divisions of the upper & middle trunks (C5 to C7)
    b) Medial cord, anterior division of the lower trunk (C8&T1)

c) Posterior cord, formed by union of posterior division of all the three trunks (C5, T1)

**THE RELATIONS OF THE BRACHIAL PLEXUS**



## TECHNIQUE OF BRACHIAL PLEXUS BLOCK

Surgical anaesthesia of the upper extremity and shoulder can be obtained at several sites following neural blockade of the brachial plexus. The various approaches are:

1.Interscalene approach

2. Supraclavicular approach

a. Classic approach

b. Plumb –bob technique

c. Subclavian perivascular technique

3. Axillary approach

4. Infraclavicular approach

**TECHNIQUE OF BLOCKADE**

**SUPRACLAVICULAR APPROACH TO BRACHIAL PLEXUS**

**SUBCLAVIAN PERIVASCULAR APPROACH**

Anatomical Land marks: The three trunks are clustered vertically over first rib cephaloposterior to subclavian artery. The neurovascular bundle lies inferior to clavicle above its mid point.

**PROCEDURE:**Patient is placed in a supine position with head turned to the opposite side from the side to be blocked. The upper limb is pushed down to

depress the clavicle. The posterior border of the sternocleidomastoid is felt by asking the patient to raise the head while keeping his head turned to the opposite side. The interscalene groove is located behind the middle point of posterior border of the muscle. The anterior and middle scalene muscle can be made prominent by asking the patient to inhale vigorously. At 1 cm above the midpoint of the clavicle, Subclavian artery pulse can be felt in the interscalene groove. Stand to the side of the patient. On the right side interscalene groove is palpated with left index finger and needle is inserted with right hand. After aseptic precautions and intradermal weal with local anaesthetics, a short bevelled 4 cm needle is inserted in the marked point. The Subclavian artery is guarded with thumb, needle is directed caudally, posteriorly and slightly medially. Needle enters the fascial sheath 1–2 cm deep to the skin approximately. Nerve block was performed by using a nerve stimulator (stimulation frequency was 2 Hz) ,stimulation intensity was decreased to less than or equal to 0.5MA after each muscular twitch; the

anesthetic volume was equally divided among arm flexion, as on exertion, wrist flexion and thumb adduction). The needle is held firmly and then local anaesthetic solution is injected after careful aspiration to exclude intravascular placement. Digital pressure proximal to needle insertion point may help to encourage distal spread.

**Complications :** 1**.** Intravascular injection

2. Pneumothorax

3.Nerve injury

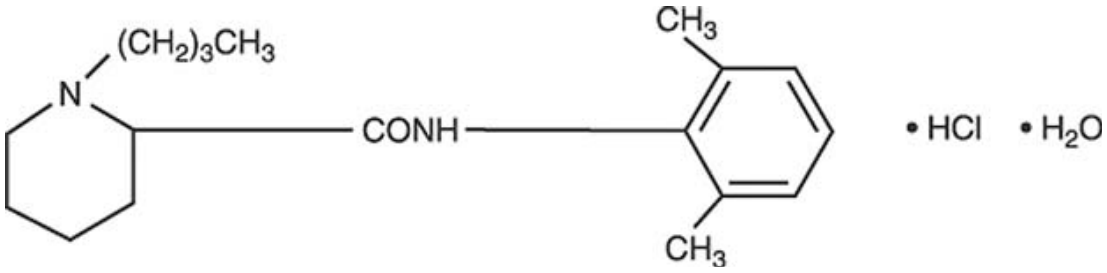
## PHARMACOLOGY OF BUPIVACAINE[5,6,7,8]

### INTRODUCTION :

Bupivacaine is one of the homologous series synthesized by A.F.Ekenstam in 1957.

Bupivacaine hydrochloride is 2-Piperidinecarboxamide,1-butyl-*N*-(2,6-dimethylphenyl)-, monohydrochloride, monohydrate, a white crystalline powder that is freely soluble in water,95 percent ethanol and slightly soluble in chloroform or acetone. First report of its use was made in 1963 by Telivuo. Bupivacaine is 3 to 4 times as potent as lignocaine.

### STRUCTURE:




### PROPERTIES :

Bupivacaine is pharmacologically and chemically related to the aminoacyl local anesthetics. It is a homologue of mepivacaine and is chemically related to lidocaine.

All the 3 of these anaesthetics contain an amide linkage between the aromatic nucleus and amino or piperidine group. They differ in this respect from procaine-type local anesthetics, which have an ester linkage.

Bupivacaine hydrochloride, an amide is readily soluble in water and has good stability. The pH of plain solution is 6.0 to 6.7. Molecular weight is 324.9. It can be stored at room temperature. It is compatible with adrenaline and can be autoclaved more than twice. Commercially available bupivacaine contains no preservative. The chemical name of bupivacaine is (DL)-1-Butyl-2-(2,6-xylocarbonyl)-piperidine.It is 3 to 4 times as potent as lignocaine.It crosses the blood brain barrier.

| | |
|---|---|
| 1.Molecular weight base | 288 |
| 2.Pka | 8.1 |
| 3.Partition coefficient | 346 |
| 4.Mean uptake ratio | 3.3 |
| 5.Protein binding | 96% |

**MODE OF ACTION :**

It causes reversible blockade of sodium conduction probably by dual actions on cell membrane.

Local anaesthetics block generation and conduction of nerve impulses, presumably by increasing threshold for electrical excitation in the nerve, by slowing the propagation of the nerve impulse, and by reducing the rate of rise in action potential. In general, the quality of the anesthesia is related to diameter, myelination, and the conduction velocity of affected nerve fibers.

The order of loss of nerve function is as follows:

(1) pain, (2) temperature, (3) touch, (4) proprioception, and (5) skeletal muscle tone.

**PHARMACOLOGICAL EFFECTS :**

The effects produced by bupivacaine may be :

(1) Local :

Nerve blockade and a direct effect on smooth muscle.

(2) Regional :

Loss of pain and temperature sensations, touch, motor power and vasomotor tone in the region supplied by the nerve blocked.

(3) Systemic :

The main systemic effects are (a)Cardiovascular system :

Gross overdose is associated with ventricular fibrillation, ventricular tachycardia and cardiac arrest.

However cardiac toxicity occurs in subconvulsive doses or in respiratory or metabolic acidosis or in severe electrolyte disturbances.

With a dose of 1.2 mg/kg given intravenously at a rate of 4.3 mg/min, there is no change in pulse rate, ECG, blood pressure and cardiac output. It causes vasodilatation in the areas supplied by the sympathetic nerves which are blocked.

(b)Central nervous system :

It produces sedation and light headedness; at times anxiety and restlessness. With marked toxicity, patient may notice a numb tongue, circumoral pin and needles, twitching and visual disturbances. Increased toxicity proceeds to convulsions and coma with respiratory and cardiovascular depression.\

(c)Autonomic nervous system :

A weak blocking action on cholinergic and adrenergic

receptors.

(d)Neuromuscular junction :

It can block motor nerves,when present in sufficient concentration.

(e)Hypersensitivity :

It can occur but more frequently in atopic patients in form of local oedema, initially generalized urticaria or angioneurotic oedema with or without lymphadenopathy. Dermatitis may be encountered as delayed reaction, but anaphylaxis is very rare.

## PHARMACOKINETICS:[9]

| | |
|---|---|
| Volume of distribution at steady state | : 72 litres |
| Terminal elimination half life | :210 minutes |
| Clearance | :0.47litres/minute |
| Metabolism | :Liver by dealkylation to pipecolyloxilidine |
| Excretion | :5% by the kidney as unchanged drug and rest as metabolite. |

**Absorption & Distribution:**

Vascularity of the tissue affects absorption of local anaesthetics. Bupivacaine has a great affinity for the negatively charged protein receptor sites. At a plasma concentration of 1 mcg/ml, the degree of protein binding is about 96.8% as opposed to 75% of lignocaine. Pharmacokinetic studies on plasma profile of Bupivacaine, after direct intravenous injection suggest a three-compartment open model.

- The first compartment is represented by rapid intravascular distribution of the drug.
- The second compartment represents equilibration of the drug throughout highly perfused organs such as myocardium, brain, lungs, kidneys & liver.

- The third compartment represents an equilibration of the drug with the poorly perfused tissues, such as muscle and fat.

The elimination of the drug from tissues depend largely upon the ability of binding sites in the circulation to carry it to the liver, where it is metabolized.

**Blood level :**

4 mcg/ml in plasma may cause convulsion. The peak plasma concentration appear slowly and reaches highest between 5-30 minutes. After reaching this level it falls slowly, this explains the longer duration of action.

**Factors affecting action**:

1.the presence of hepatic or renal disease

2.addition of epinephrine

3.factors affecting urinary pH, renal blood flow

4.the route of drug administration

5.the age of the patient.

The half-life of Bupivacaine in adults is 2.7 hours and in neonates 8.1 hours.

**Placental transfer :**

As bupivacaine is highly protein bound, it passes to the fetus in a slower rate.It is not likely to cause fetal plasma concentration equal to that of maternal. Neonatal depression is not found with bupivacaine.

**Metabolism :**

It is rapidly catabolised like the other local anaesthetics and is mainly metabolised in the liver, demethylation of piperidene ring and coupling of glucuronic acid and N-dealkylation to pipecolyxylidine (PPX) which is then hydrolysed. It has a fairly rapid rate of elimination from blood, because of the faster tissue uptake and rapid rate of metabolism and hence there is hardly any accumulation of drug in the body, even after prolonged administration. Clinically found blood levels are much below the toxic dose.

**Excretion :**

Bupivacaine is excreted through the bile duct and kidney.

The kidney is the main excretory organ for local anesthetics and their metabolites. Urinary excretion is affected by renal perfusion and factors affecting urinary pH. Only 6% of Bupivacaine is excreted unchanged in urine.

**Uses :**

The uses are :

(1) Local infiltration anaesthesia 0.25%

(2) Nerve blocks 0.25% and 0.5%

(3) Spinal anaesthesia 0.5%

(4) Epidural analgesia : labour and post-operative analgesia 0.25% and 0.5%

(5) Intravenous regional anaesthesia (IVRA)

**Doses:**[10,11]

It is available in 0.5% 20 ml vial,4 ml ampoule and 2 ml 1% ampoule.

Safe dose is 2 mg/kg of the body weight. Wide field block and

surface application of bupivacaine causes toxic reaction.

## PHARMACOLOGY OF CLONIDINE

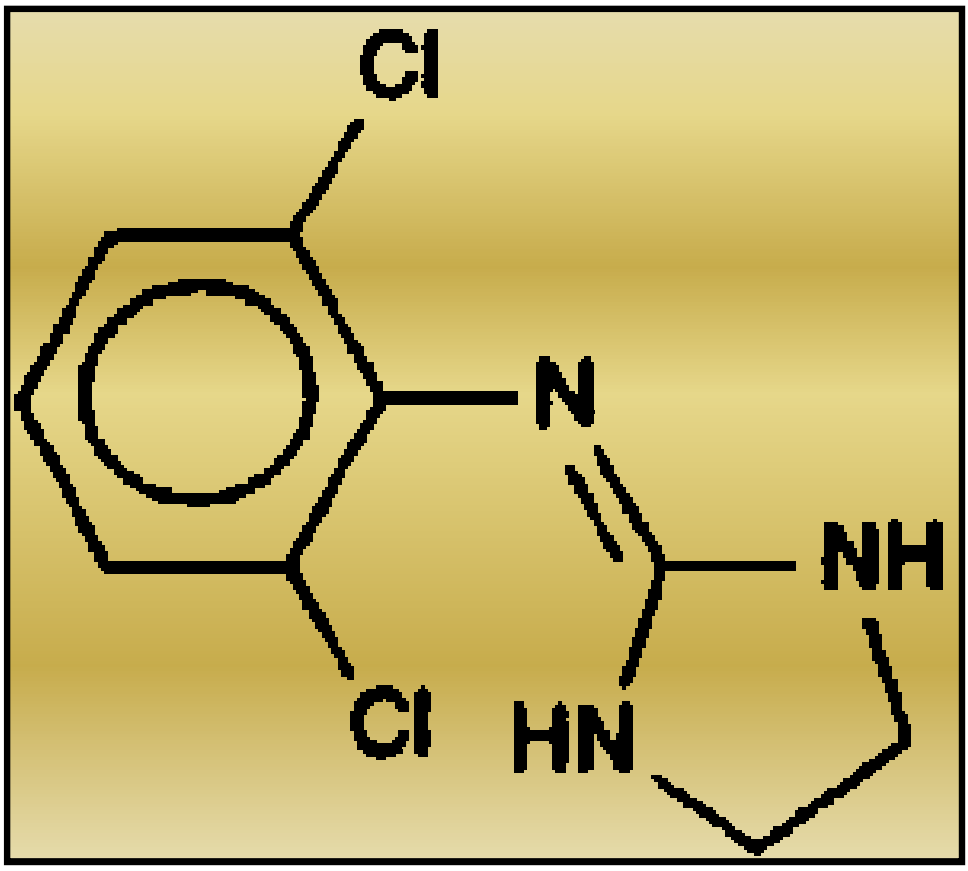
### Introduction:

Clonidine hydrochloride is a centrally acting selective partial alpha – 2 agonist introduced in early 1960s.

Clonidine hydrochloride is an imidazoline compound and exists in a mesomeric form.The structural formula is C9H9C12N3HCI. The chemical name is 2-(2,6–dichlorophenylamino)-2 imidazoline hydrochloride..

The molecular weight is 266.56. Clonidine is an odourless, bitter, white, crystalline substance, soluble in alcohol and water. Clonidine improves quality of anaesthesia, provides more cardiovascular stability during anaesthesia, presumably because of its sympatholytic effect. Clonidine potentiates anaesthetic action of the local anaesthetics with fewer side effects in peripheral nerve blocks and central neuraxial blockade.. Clonidine may reduce the halothane MAC by upto 50% in a dose dependent manner.

**CLONIDINE HYDROCHLORIDE**




**Availability :**

Available as one ml ampoule containing 150 micrograms. It should be stored below 25 degree Celsius.

**Mechanism of action:**[12]

Clonidine is a centrally acting partial α2 adrenergic agonist with a selectivity ratio of 220: 1 for α2 receptors. The 3 subtypes of α2 receptors are α2a,α2b,α2c. α2a receptors mediate sedation, analgesia, sympatholysis.

α2b receptors mediate vasoconstriction and anti- shivering. The startle response may reflect the activation of α2c receptors. The drug is lipid soluble, penetrates blood brain barrier to reach the hypothalamus and medulla, when injected epidurally. It stimulates the inhibitory α2 adrenoreceptors and reduce central neural transmission in spinal neurons. The analgesic effect is caused by inhibition of substance-P.

The α2 adrenoreceptors are located on afferent terminals of both peripheral and spinal neurons in the superficial laminae of the spinal cord and within several brain stem nuclei involved in analgesia. The superficial laminae contain three groups of neurons: tonic, adapting, single- spike firing, all of which receive their primary sensory input from Aδ and C fibres.The ability of clonidine to modify the function of potassium channels in the CNS (Cell membrane become hyperpolarized) may be the mechanism for profound decrease in anaesthetic requirements. Clonidine inhibits voltage gated Na + and K+ channels and suppresses the generation of action potentials in tonic- firing spinal dorsal horn neurons, contributing to analgesic effect.

There have been four proposed mechanisms for the action of clonidine in peripheral nerve blocks. These mechanisms are centrally mediated analgesia. $\alpha_2$adrenoceptormediated vaso-constrictive effects, attenuation of inflammatory response and direct action on peripheral nerve.

Another contribution to analgesic effect may be through the release of acetylcholine in the neuraxial region. α2adrenergic agonists also enhance analgesia from intraspinal opioids. Sedation is produced by its action on locus ceruleus.

In the periphery, it acts on pre-synaptic α2 adrenoreceptors at sympathetic terminals , reduces the release of nor-epinephrine, causing vaso-relaxation and reduced chronotropic drive. The brainstem and peripheral effects of α2 adrenoreceptor stimulation are counter balanced by the direct peripheral vasoconstriction through its action on α2 adrenoreceptors from the circulating concentrations of clonidine.

Sedation is a desired property. Clonidine produces a dose dependent sedation at the dose of 50 micrograms or more in less than 20 minutes regardless of the route of administration.

Clonidine doesn't induce profound respiratory depression even after massive overdose nor do they potentiate respiratory depression of opioids.

In peripheral nerves, it produces a little blockade at high concentrations with some preference for C- fibres in the peripheral nerves and this effect in part enhance the peripheral nerve block, when added to local anaesthetics, probably because the α2 adrenoreceptors are absent in the axons of peripheral nerves.

**Pharmacokinetics:**[13,14,15,16]

Clonidine is well absorbed orally .It is nearly 100% bio-available, reaches peak plasma concentration with in 60 to 90 minutes. The mean half life of the drug in plasma is about 9 to 12 hours. Approximately 50% is metabolized in the liver whereas it is excreted in an unchanged form by the kidney, and its half- life can dramatically increase in the presence of impaired kidney function.

A transdermal delivery system is available in which the drug is released at a constant rate for a week. Three or four days are required to achieve a steady state concentration.

Clonidine is highly lipid soluble and readily distribute into extra-vascular sites including the central nervous system.

300 micrograms intravenously over 10 min produces:

| | | |
|---|---|---|
| Distribution t ½ | : | 11 ± 9 minutes |
| Plasma t ½ | : | 8 -12 hrs |
| Elimination t ½ | : | 9 ± 2 hours, 41hours in severe renal failure. |
| Volume of distribution | : | 2.1± 0.4 l/kg |
| Plasma protein binding | : | 20 - 40% in vitro |
| Plasma clearance | : | 12.6 L/hr/70 kg |
| Metabolism | : | minor pathways with the major metabolite, P – hydroxyclonidine. |

**Excretion:**

70% of the dose is excreted in the form of unchanged parent drug (40 – 60%) in the urine. So, the elimination t ½ of clonidine varies as a function of creatinine clearance. In subjects undergoing hemodialysis, only 5% of the body clonidine was removed.

**Precautions:**

In patients with renal failure, lower dose is needed. Sudden withdrawal of prolonged continuous epidural infusion produces a hypertensive crisis. Hence used with caution in patients with cerebrovascular or coronary insufficiency.If a patient with beta blocker is on continuous epidural therapy, beta blocker should be withdrawn several days before discontinuation of epidural clonidine.

**Contraindications:**

1. Known hypersensitivity to clonidine or its components.
2. In patients with bradyarrhythmia or AV block
3. Patients with severe cardiovascular disease
4. Patients with cardiovascular and hemodynamic instability.

**Interactions:**

1. Clonidine may potentiate the CNS depressive effect of alcohol, barbiturates or other sedative drugs.
2. Narcotics may potentiate the hypotensive effects of clonidine.

3. Tricyclic anti-depressants may antagonize the hypotensive effects of clonidine.
4. Concomitant administration of drugs with a negative chronotropic dromotropic effect (beta blocker, digoxin) can cause or potentiate bradycardiac rhythm disturbances.
5. Beta blockers may potentiate hypertensive response seen with clonidine withdrawal.
6. Epidural clonidine may prolong the duration of pharmacologic effects of epidural local anaesthetics, opioids, neostigmine and other drugs.

Clonidine readily crosses placental barrier and may lower the foetal heart rate.Use of clonidine as an analgesic during labor and delivery is not indicated because maternal perfusion of the placenta is critically dependant on the blood pressure.

In human breast milk, clonidine concentration are approximately twice that of maternal plasma.So it is contra indicated in lactating women.

**Uses :**[16]

- Pre-anaesthetic medication
- Decrease anaesthetic requirements for inhaled and injected anaesthetics.
- Clonidine also attenuates rise in intraocular pressure associated with laryngoscopy and intubation
- Epidural block
- Spinal anaesthesia
- Caudal anaesthesia
- Peripheral nerve blocks : Clonidine prolongs duration of anaesthesia and analgesia with local anaesthetics by 2 times in a dose of 75 to 150 micro grams.
- Bier's Block : 150 microgram of clonidine enhances the tourniquet tolerance
- It is also used in intra-articular analgesia

- Protection against perioperative myocardial ischemia; clonidine decreases myocardial ischemia, infarction and mortality following cardiovascular surgery.
- To treat hypertensive crisis
- Diagnosis of pheochromocytoma
- Treatment of shivering
- Treatment for opioid and alcohol withdrawal syndrome.

**Side effects;**

1. The most common side effects are sedation and xerostomia
2. Cardiovascular complications are bradycardia, hypotension, and ECG abnormalities like sinusnode arrest, junctional bradycardia; high degree AV block and arrhythmia are reported rarely. Occasionally require treatment for bradycardia with I.V anticholinergics. Orthostatic hypotension occurs rarely.
3. Rebound hypertension; Abrupt discontinuation of clonidine can result in rebound hypertension as soon as 8 hours and as late as 36 hours ,after the last dose.

Symptoms of nervousness, diaphoresis, headache, abdominal pain, and tachycardia often precede the actual increase in systemic blood pressure. Labetalol is useful in treatment of rebound hypertension.

4. Skin rashes occur frequently.

5. Impotence occurs occasionally.

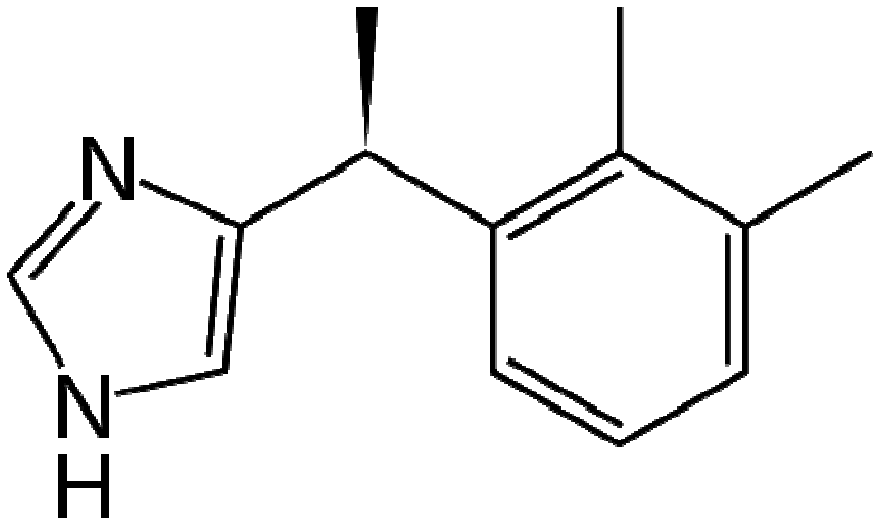
**OVER DOSAGE:**

An overdosage of clonidine can produce vasospasm and hypertension. For hypertensive emergency,IV furosemide, diazoxide and alpha blocking agents may be used. There is no specific antidote for clonidine overdosage. Supportive measures like atropine, ephedrine, and i.v. fluids are enough.Yohimbine partially reverses the analgesia and sedation but not the BP and heart rate changes produced by epidural clonidine.

## PHARMACOLOGY OF DEXMEDETOMIDINE

Dexmedetomidine is a relatively selective alpha2-adrenoceptor agonist with Centrally mediated sympatholytic, sedative and analgesic effects. In general, dexmedetomidine has similar pharmacological effects to clonidine, which has been described as a useful and safe adjunct in many clinical applications. It provides a unique "conscious sedation" (patients appear to be asleep, but are readily roused), analgesia, without respiratory depression. Dexmedetomidine infusions are used for sedation in mechanically ventilated patients.

**STRUCTURE:**




**MECHANISM OF ACTION OF DEXMEDETOMIDINE**

Alpha2 -receptors are found in many sites in the central nervous system. However, the highest densities of alpha2-receptors are found in the locus ceruleus .Presynaptic activation of the alpha2-A receptor in the locus ceruleus inhibits the release of norepinephrine and results in the sedative and

hypnotic effects. In addition, the locus ceruleus is the site of origin for the descending medullospinal noradrenergic pathway,known to be an important modulator of nociceptive neurotransmission. Stimulation in this area terminates the propagation of pain signals leading to analgesia. Presynaptic activation of alpha2-adrenoceptorresults in decrease in sympathetic activity leading to hypotension and bradycardia. Also, activation of the alpha2- receptors results in an augmentation of the cardiac vagal activity. When combined, these effects can produce analgesia, sedation and anxiolysis.

At the spinal cord, stimulation of alpha2-receptors at the substantia gelatinosa of the dorsal horn leads to inhibition of the firing of nociceptive

neurons and inhibition of the release of substance P. Also, the alpha2-adrenoceptors located at the nerve endings have a possible role in the analgesic mechanisms by preventing nor-adrenaline release. The spinal mechanism is the principal mechanism for the analgesic action of dexmedetomidine even though there is a clear evidence for both supraspinal and peripheral sites of action.

**PHARMACOKINETICS**

Following intravenous administration, dexmedetomidine exhibits the following pharmacokinetic parameters: a rapid distribution phase with a distribution half-life of approximately 6 minutes; a terminal elimination half-life of approximately 2 hours; and a steady-state volume of distribution of approximately 118 litres.

Clearance is estimated to be approximately 39 lit/hr and plasma protein binding is about 94%.

**METABOLISM AND ELIMINATION**

Dexmedetomidine undergoes almost complete biotransformation with minimal unchanged dexmedetomidine excreted in urine and faeces. Hepatic metabolism involves both direct glucuronidation and oxidative metabolism.

The major metabolic pathways of dexmedetomidine are the direct N-glucuronidation to inactive metabolites, aliphatic hydroxylation (mediated primarily by(CYP2A6) and N-methylation. Dexmedetomidine exhibits linear pharmacokinetics at therapeutic doses; the terminal elimination half-life is approximately 2 hours. About 95% of the total dose is recovered in the urine

and 4% in the feces by nine days following intravenous administration.No unchanged dexmedetomidine is detected in the urine.

**SIDE EFFECTS**

Dexmedetomidine crosses the placenta and its safety is not established in pregnancy and in children. The common adverse effects of dexmedetomidine include hypotension, transient hypertension, nausea, bradycardia, atrial fibrillation, hypoxia and various atrioventricular blocks. Most of these adverse effects occur during the bolus dose of the drug. Omitting or reducing the loading dose can reduce the adverse effects.

**DOSAGE**

Dexmedetomidine prolongs the duration of anaesthesia and analgesia with local anaesthetics by two times in a dose of 1 µg/kg."

# REVIEW OF LITERATURE

"A study conducted by **Dalle *et al*** in 2001 explains the direct action of clonidine in nerve blockade. They proposed that clonidine, by enhancing the activity dependent hyperpolarisation generated by Na/K pump during repetitive stimulation, increases threshold for initiating the action potential causing slowing or blockage of conduction[17].

A study conducted by **Hutschala et al** in 2004, by adding 100µg clonidine to bupivacaine 0.25%.It was found that adding the alpha 2 agonist clonidine to local anaesthetic agent bupivacaine enhances pain relief after peripheral nerve block.The lower plasma concentration of clonidine after peripheral nerve blockade strongly suggest a local effect.Administration of clonidine along with bupivacaine was associated with minimal sedation and a decrease in heart rate and stable blood pressure[18].

**Masuki et al** in 2005,suggested that dexmedetomidine induces vasoconstriction via α2 adrenoceptors in the human forearm possibly also causing vasoconstriction around the site of injection,prolonging the effect of local anaesthetic by delaying its absorption.[19]

**Giovanni Cucchiaro and Arjunan Ganesh** in 2007, evaluated effects of clonidine added to local anaesthetic bupivacaine for upper limb surgeries. Each group of 200 patients received either plain bupivacaine(LA) or bupivacaine with clonidine(LAC).Duration of sensory and motor blockade was significantly longer in LAC 1µg/kg group compared to LA group.They concluded that adding clonidine to bupivacaine prolonged the sensory and motor blockade[20].

**Yoshitomi et al** in 2008,demonstrated that clonidine as well as dexmedetomidine enhanced the local anaesthetic action of lignocaine via peripheral α2 A adrenoceptors.Other studies have shown that clonidine prolongs

the duration of anaesthesia and analgesia in brachial plexus block when added to bupivacaine[21]

A study by **Brumett *et al*** in 2008, showed that dexmedetomidine enhances the duration of bupivacaine anaesthesia and analgesia of sciatic nerve block in rats, without any damage to the nerve. The histopathological evaluation of these nerve axons and myelin were normal in both control and dexmedetomidine with bupivacaine groups[22].

In an another study, perineural dexmedetomidine added to ropivacaine for sciatic nerve block in rats, prolonged the duration of analgesia, by blocking the hyperpolarisation-activatedcation. This effect was reversed by a hyperpolarisation activated cation channel enhancer,but not by an α2 adrenoreceptor antagonist. This shows that analgesic effect of peripheral perineural dexmedetomidine was caused by the enhancement of hyperpolarisation-activated cation current, which prevents the nerve from returning from a hyperpolarized state to resting state[23].

**Popping *et al.*** in 2009 in their metaanalysis of randomized trials, showed that beneficial effect of clonidine on duration of analgesia was observed with all the tested local anaesthetics. They observed that prolongation of motor block was higher, when clonidine was added to bupivacaine as compared with ropivacaine. The least effect was noted with prilocaine[24].

**Kousugi *et al.*** in 2010examined effects of various adrenoceptor agonists including dexmedetomidine, tetracaine, oxymetazoline and clonidine and also an α2 adrenoceptor antagonist (atipamezole) on compound action potential (CAP) recorded from frog sciatic nerve, and found that CAPs were inhibited by α2 adrenoceptor agents so that they are able to block nerve conduction[25]. Dexmedetomidine and clonidine are both α2 selective agonists. It is

possible that they work in a similar manner and may indicate a class effect.

**Kosugi et *al.*** in their study found that high concentrations of dexmedetomidine inhibit CAPs in frog sciatic nerves without 2 adrenoceptor activation. Their result showed that dexmedetomidinereduced peak amplitude of CAPs reversibly and in a concentration- dependent manner. This action was not antagonized by α2 adrenoceptor antagonists (i.e.,yohimbine and atipamezole). In fact,α2 antagonists reduced the CAP peak amplitude. Clonidine and oxymetazoline, two other α2 agonists, also inhibit CAPs. The maximum effect of clonidine was only 20%.

Studies by **Brummett and Kosugi** showed that adrenaline, noradrenaline and α1 agonist phenylephrine \ and beta agonist isoprenaline had no effect on CAPs. The efficacy of peripheral perineural dexmedetomidine added to bupivacaine and ropivacaine for sciatic nerve blocks has been established[22, 23].The increase in duration of analgesia is dose dependent[21] and the effect is peripheral (i.e., not caused by centrally mediated or systemic analgesia)

**Esmaoglu et al** in 2010, have done human studies on greater palatine and axillary brachial plexus nerve blocks have subsequently demonstrated that increased duration of sensory blockade can be achieved by adding dexmedetomidine to bupivacaine and levobupivacaine, respectively[26.] Keeping these facts in mind, we decided to compare the action of two α2 agonists, i.e. clonidine and dexmedetomidine with bupivacaine in lesser concentration (0.25%), in peripheral nerve blocks so that by increasing the duration of analgesia with a single shot block, we can achieve a longer duration of post-operative analgesia without significant.

**Singelyn *et al*.** reported that a minimum dose of clonidine (0.5 μg/kg) added to mepivacaine prolongs the duration of anaesthesia and analgesia after brachial plexus block. No added benefits were found with doses exceeding 1.5 μg/kg. The enhancing effect of a small dose of clonidine on lignocaine may be because of the evoked inhibition of C-fiber action potential.

Therefore, we decided to use clonidine at a dose of 1 μg/kg in our study[28]. Although dexmedetomidine has a α2/α1 selectivity ratio that is eight-times higher than that of clonidine, an equipotent comparative study of both the drugs in peripheral nerve block was not available at the time of our study.

**Rachana Gandhi et al** in 2012,conducted a study to compare the postoperative analgesic efficacy and safety of dexmedetomidine for brachial plexus blockade along with bupivacaine.They used dexmedetomidine in the dose of 30 μg in 2 ml added 38 ml of 0.25% bupivacaine.They concluded that Dexmedetomidine prolonged the duration of sensory and motor blockade[36].

**Swami SS et al** in 2012 have compared the efficacy of clonidine and dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block.However the dose they have used for clonidine and dexmedetomidine was 1μg/kg each.They concluded that dexmedetomidine prolongs the duration of sensory and motor block and enhances the quality of block as compared with clonidine[32].

**Amany S.Ammar et al** in 2012 studied the effect of adding dexmedetomidine to bupivacaine in infraclavicular brachial plexus block. The dose of dexmedetomidine added to 38 ml of 0.25 % of bupivacaine was 1μg/kg[29].

They concluded that adding dexmedetomidine as an adjuvant prolonged the duration of sensory and motor blockade.

**Rao et al** in 2014 have compared the efficacy of clonidine and dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block in a dose of 1 µg/kg (in 2ml) added to 38 ml of 0.25% bupivacaine. Dexmedetomidine is more effective than clonidine when added to bupivacaine in supraclavicular brachialplexus block as it reduces onset of block and causes greater prolongation of both sensory and motor block[33].

**Sandhya Agarwal et al** in 2014,compared the effect of adding dexmedetomidine to bupivacaine in supraclavicular brachial plexus block for upper limb surgeries. They added 1µg/kg of dexmedetomidine to 38ml of 0.25% bupivacaine[35]. They concluded that dexmedetomidine when added to bupivacaine for supraclavicular brachial plexus block shortens the onset times for sensory and motor blocks and prolongs their duration. The significantly prolonged duration of analgesia obviates the need for any additional analgesics. The added advantage of conscious sedation, hemodynamic stability, and minimal side effects makes it a potential adjuvant for nerve blocks. Patients in dexmedetomidine group were adequately sedated (modified Ramsay Sedation Score, RSS = 2/6 or 3/6)
with no adverse effects except bradycardia in one patient.

**Kenan Kaygusuz et** al in 2012,studied effects of adding Dexmedetomidine to Levobupivacaine in Axillary Brachial Plexus Block. They added 1µg/ml of dexmedetomidine to 39 ml of 5% bupivacaine.They concluded that adding dexmedetomidine to axillary brachial plexus block shortens onset time of sensory block, increases the duration of sensory and motor blockade.

**Harshavardhana H S et al** in 2014,conducted a study to Efficacy of Dexmedetomidine compared to Clonidine added to Ropivacaine in Supraclavicular Nerve Blocks. They added 1µg/kg of either clonidine or dexmedetomidine to 38 ml of 0.25% bupivacaine. They concluded that Dexmedetomidine when added to ropivacaine for brachial plexus block is a better adjuvant compared to clonidine[30].

**Saurabh Singh et al** in 2014,conducted a study to compare the duration of sensory & motor blockade between clonidine & dexmedetomidine as adjuvants to 0.25% bupivacaine and to compare the hemodynamic parameters i.e. Heart rate, systolic blood pressure & diastolic blood pressure between the clonidine and dexmedetomidine groups. They added 1µg/kg of either clonidine or dexmedetomidine to 38 ml of 0.25% bupivacaine. They concluded that Dexmedetomidine significantly prolonged the duration of action and significant decrease in haemodynamic parameters, but did not require any active intervention[31]."

# MATERIALS AND METHODS

This study was carried out in the orthopaedic and plastic surgery theatre of Thanjavur Medical college,Thanjavur.

A prospective double blinded randomized controlled study was conducted on 60 ASA I and II patients undergoing upper limb surgeries under supra clavicular brachial plexus block who fulfill inclusion criteria.

This study was started after getting institutional ethical committee approval and informed written consent from all the patients undergoing the study.They were randomly divided into 2 groups namely group C and group D

Group C (Bupivacaine + clonidine) – 30 patients received 38 ml of 0.25% Bupivacaine and 100 micrograms of clonidine

Group D (Bupivacaine + dexmedetomidine) – 30 patients received 38 ml of 0.25% bupivacaine and 100 micrograms of dexmedetomidine.

# INCLUSION CRITERIA

The following criteria were taken for including the patients in this study

a) ASA status I and II

b) Age between 16 and 60

c) Weight between 40 and 70 kg

d) Surgeries of moderate duration (60 to 90 minutes)

e) Surgeries on distal end of arm ,forearm and hand

# EXCLUSION CRITERIA

a) Patient refusal

b) Known allergy for the drugs to be studied

c) Local infections / sepsis

d) Coagulation abnormalities

e) Alcohol / drug abuse

f) Pregnant and lactating women

g) Patient receiving chronic analgesic therapy

h) Patients with severe cardiopulmonary disease, thyroid disorders,diabetes mellitus and central or peripheral neuropathies

i) Other contraindications to regional anaesthesia

# MATERIALS

1.sterile tray,sterile swab, sterile towel, sponge holding forceps

2. drugs for the block

0.25% bupivacaine

Inj.clonidine

Inj.dexmedetomidine

3.Nerve stimulator with insulated needle

4.Equipments and drugs for resuscitation and conversion to general anaesthesia in case of block failure.

# METHODS:

## PRE-OPERATIVE PREPARATION:

Patients were preoperatively assessed and the procedure was explained to the patient . Written informed consent of all the patients under study was taken. Basic investigations recommended for ASA physical status I and II patients like hemoglobin, random blood sugar , blood urea, serum creatinine, urine for albumin and sugar and electrocardiogram were reviewed.

All the patients were premedicated with Inj.Ranitidine 50 mg and Inj. Ondensetron 8 mg prior to the surgery. On arrival of patients to the operating room monitors like pulse oximeter , non invasive blood pressure and ECG were

connected. Baseline values were recorded. An 18G intravenous cannula was inserted in the contralateral forearm and an IV infusion started.

## SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

Anatomical Land marks: The three trunks are clustered vertically over first rib cephaloposterior to subclavian artery. The neurovascular bundle lies inferior to clavicle above its mid point.

**PROCEDURE:**Patient were positioned supine with head turned to the opposite side from the side to be blocked. The upper limb was pushed down to depress the clavicle. The posterior border of the sternocleidomastoid was felt by asking him to raise the head while keeping his head turned to the opposite side. The interscalene groove should be located behind the middle point of posterior border of the muscle. The anterior and middle scalene muscle can be made prominent by asking the patient to inhale vigorously. At 1 cm above the midpoint of the clavicle,

Subclavian artery pulsation can be felt in the interscalene groove. Stand to the side of the patient. On the right side, interscalene groove is palpated with left index finger and needle is inserted with right hand. After aseptic precautions and intradermal weal with local anaesthetics, a short bevelled 4 cm needle is inserted in the marked point. The Subclavian artery is guarded with thumb, needle is directed caudally, posteriorly and slightly medially. Needle enters the fascial sheath 1–2 cm deep to the skin approximately. Nerve block were performed by using a nerve stimulator (stimulation frequency was 2 Hz ,stimulation intensity was decreased to less than or equal to 0.5MA after each muscular twitch; the anesthetic volume was equally divided among arm flexion, wrist flexion and thumb adduction). The needle is held firmly and then local anaesthetic solution is injected after careful aspiration to exclude intravascular placement. Digital pressure proximal to needle insertion point may help to encourage distal spread.

In the absence of a desired response, the needle was redirected cephalad or caudad, but never medially to avoid the pleura. When these manoeuvers failed to result in desired motor response the needle was withdrawn and the landmarks were reassessed and tried again.

## EVALUATION OF THE BLOCK:

Evaluation of degree of blockade was done by Hollmen's scale

## HOLLMEN'S SCALE

### SENSORY BLOCKADE:

1.Normal sensation of pin prick

2.Pin prick felt as sharp pointed but weaker compared with the same area with the other limb

3.Pin prick recognized as touch with blunt object

4.No perception of pin prick

**MOTOR BLOCKADE:**

1.Normal muscle function.

2.Slight weakness in muscle function

3.Very weak muscular action

4. Complete loss of muscle function

- Following the administration of the drug , the patients were evaluated for onset of sensory and motor blockade every minute
- **Onset of sensory block:** The time interval between administration of drug and absence of sensation to pin prick (Hollmen's ≥3).
- **Onset of motor blockade:** Time interval between administration of the drug and complete loss of muscle function(Hollmen's ≥3) Motor block was assessed by wrist flexion and extension or finger flexion and extension .Only patients with complete motor block was included in this study.

- **Duration of sensory blockade:**Time interval between onset of complete sensory block and the onset of pain in the post operative period
- **Duration of motor blockade :**Time interval between onset of complete motor block and the recovery of normal muscle power
- Failed block was managed with general anaesthesia. Those patients are excluded from the study.
- After conformation that the block has taken up , surgery was started.
- Patient received supplemental O2 and intravenous fluids throughout the procedure.
- Sedation was assessed using sedation scale described by Culebras for 24 hours postoperatively(14)

  Group 1:Awake and alert

  Group 2: sedated , responding to verbal commands

Group 3: sedated , responding to mild physical stimulus

Group 4: sedated, responds to moderate or severe physical stimulus

Group 5: not arousable

- Local anesthetic toxic reactions including subjective manifestations like circumoral numbness, tinnitus, twitching,convulsions,etc.,were looked for and appropriate resuscitative drugs were kept ready.
- Complications associated with the technique like intravascular injection and pneumothorax were looked for and appropriate measures were taken to meet any such eventuality.
- Heart rate , non invasive blood pressure, oxygen saturation and sedation scores were recorded at 0 min,5 min, 10 min, 15 min, 30 min, 60 min, 2 hrs, 6 hrs, 12 hrs and 24 hrs
- Inj. Diclofenac 75 mg intramuscularly was given as a rescue analgesic when the patient complains of pain in the postoperative period.

- Patients were observed for 24 hrs for the following side effects.

    a) Bradycardia; heart rate less than 60 beats / min

    b) Hypotension ; more than 30% decrease from base line value

    c) Shivering

    d) Dry mouth

    e) Arrhythmias

    f) Local anaesthetic toxicity

All the data were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS), version 15. Duration of sensory and motor block, and haemodynamic parameters were subjected to Independent t-test for statistical analysis. P-value $< 0.05$ was considered as statistically significant and $P < 0.001$ as highly significant.

# OBSERVATIONS AND RESULTS

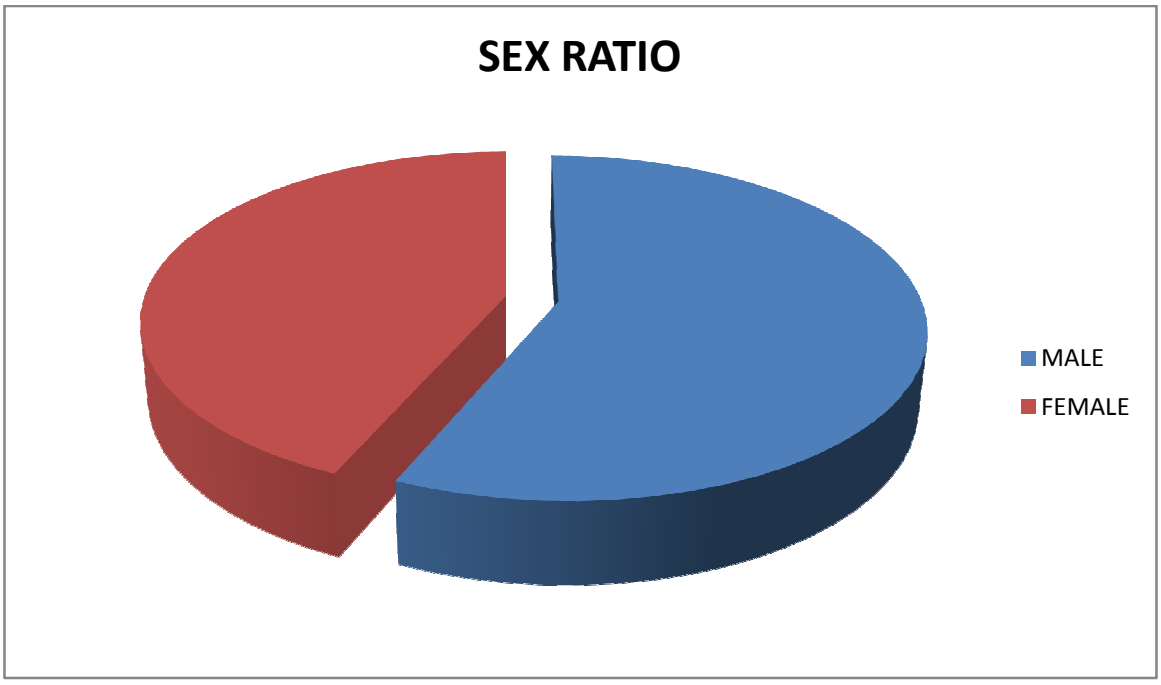
All the data were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS), version 15. Duration of sensory and motor block, and haemodynamic parameters were subjected to Independent t-test for statistical analysis. P-value $< 0.05$ was considered as statistically significant and $P < 0.001$ as highly significant.

**SEX DISTRIBUTION**

| SEX | C GROUP | D GROUP | TOTAL |
|---|---|---|---|
| MALE | 16 | 18 | 34 |
| FEMALE | 14 | 12 | 26 |
| TOTAL | 30 | 30 | 60 |

Male to female ratio in group C was 53/47

and in group D was 60/40, which were comparable




Comparison of sex distribution between Group C(Clonidine with Bupivacaine) and Group D(Dexmedetomidine with Bupivacaine)

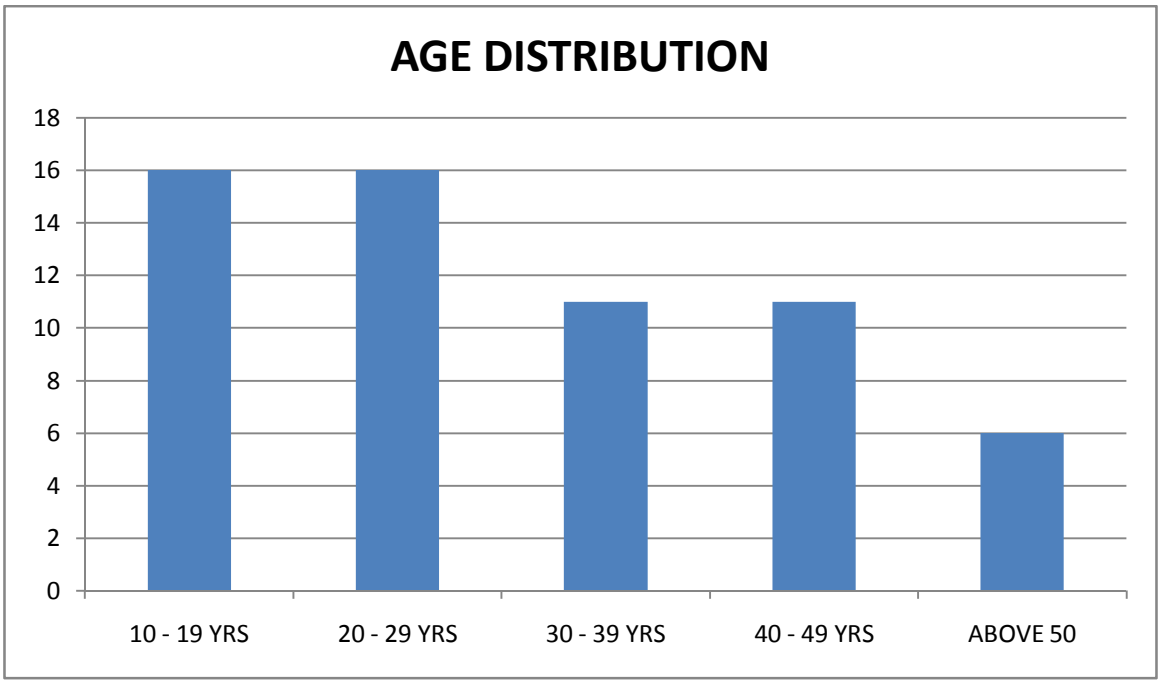
**AGE DISTRIBUTION**

| AGE | C GROUP | D GROUP | TOTAL | 'p' value |
|---|---|---|---|---|
| 16 – 20 YRS | 6 | 10 | 16 | |
| 20 -29 YRS | 9 | 7 | 16 | |
| 30-39 YRS | 5 | 6 | 11 | 0.308 |
| 40-49 YRS | 7 | 4 | 11 | |
| ABOVE 50 | 3 | 3 | 6 | |
| TOTAL | 30 | 30 | 60 | |
| Mean | 33.33±14.55 | 29.13±12.59 | | |

Mean age in group C is 33.33±14.55

Mean age in group D is 29.13±12.59

These mean ages were comparable




Comparison of age distribution between Group C(Clonidine with Bupivacaine) and Group D(Dexmedetomidine with Bupivacaine)

**WEIGHT DISTRIBUTION**

**Descriptive Statistics**

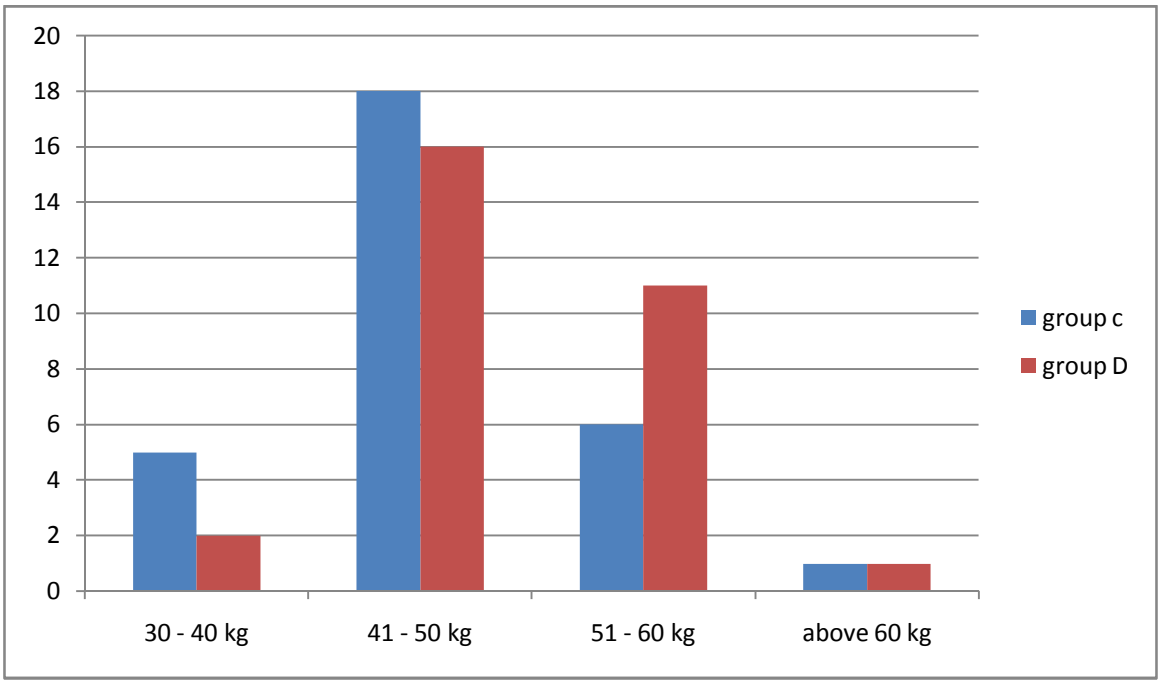
| GROUP | | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| C | WEIGHT | 30 | 35.00 | 65.00 | 47.8667 | 6.17410 |
| | Valid N (listwise) | 30 | | | | |
| D | WEIGHT | 30 | 40.00 | 60.00 | 49.6667 | 4.43601 |
| | Valid N (listwise) | 30 | | | | |

Mean weight in group C was 47.86±6.17

Mean weight in group D was 49.66±4.43

These mean weights were comparable in both groups.

**COMPARISON OF WEIGHT DISTRIBUTION BETWEEN GROUP C AND GROUP D**




Weight distribution as compared between Group C(Clonidine with Bupivacaine)

and Group D(Dexmedetomidine with Bupivacaine)

**COMPARISON OF HAEMODYNAMIC PARAMETERS AND SEDATION SCORE BETWEEN C AND D GROUPS**

| GROUP | | N | Mean | | Std. Deviation | 'P' value |
|---|---|---|---|---|---|---|
| | | Statistic | Statistic | Std. Error | Statistic | |
| C | PULSE RATE | 30 | 79.2667 | 1.22703 | 6.72070 | Pulse rate=0.166 |
| | MEAN ARTERIAL PRESSURE | 30 | 75.1000 | 1.41369 | 7.74307 | Mean pressure= 0.095 |
| | SATURATION | 30 | 99.1667 | .06920 | .37905 | Saturation= 0.139 |
| | SEDATION SCORE | 30 | 1.0000 | .00000 | .00000 | Sedation score= 0.001 |
| | Valid N (listwise) | 30 | | | | |
| D | PULSE RATE | 30 | 79.2333 | 1.46506 | 8.02446 | |
| | MEAN ARTERIAL PRESSURE | 30 | 71.4333 | .95615 | 5.23703 | |
| | SATURATION | 30 | 99.0333 | .05839 | .31984 | |
| | SEDATION SCORE | 30 | 2.0000 | .00000 | .00000 | |
| | Valid N (listwise) | 30 | | | | |

## COMPARISON OF PULSE RATE BETWEEN GROUP C AND D

| PULSE RATE | | | | | |
|---|---|---|---|---|---|
| GROUP | N | Mean | | Std. Deviation | 'P' Value |
| | Statistic | Statistic | Std. Error | Statistic | |
| C | 30 | 79.2667 | 1.22703 | 6.72070 | 0.308 |
| D | 30 | 79.2333 | 1.46506 | 8.02446 | |

The mean pulse rate in group C was 79.26±6.72

The mean pulse rate in group D was 79.23±8.02

These rates were statistically comparable

**COMPARISON OF MEAN ARTERIAL PRESSURE BETWEEN GROUP C AND GROUP D**

| MEAN ARTERIAL PRESSURE | | | | | |
|---|---|---|---|---|---|
| GROUP | N | Mean | | Std. Deviation | 'P' value |
| | Statistic | Statistic | Std. Error | Statistic | |
| C | 30 | 75.1000 | 1.41369 | 7.74307 | 0.095 |
| D | 30 | 71.4333 | .95615 | 5.23703 | |

The mean arterial pressure in group C was 75.100±7.74

The mean arterial pressure in group D was 71.43±5.23

These means were statistically comparable

**COMPARISON OF OXYGEN SATURATION BETWEEN GROUP C AND GROUP D**

| SATURATION | | | | | |
|---|---|---|---|---|---|
| GROUP | N | Mean | | Std. Deviation | 'P' value |
| | Statistic | Statistic | Std. Error | Statistic | |
| C | 30 | 99.1667 | .06920 | .37905 | 0.139 |
| D | 30 | 99.0333 | .05839 | .31984 | |

The mean oxygen saturation in group C was 99.16±0.37

The mean oxygen saturation in group D was 99.03±0.31

These means were statistically comparable

**COMPARISON OF SEDATION SCORE BETWEEN GROUP C AND GROUP D**

| SEDATION SCORE | | | | | |
|---|---|---|---|---|---|
| GROUP | N | Mean | | Std. Deviation | 'P' Value |
| | Statistic | Statistic | Std. Error | Statistic | |
| C | 30 | 1.0000 | .00000 | .00000 | 0.000 |
| D | 30 | 2.0000 | .00000 | .00000 | |

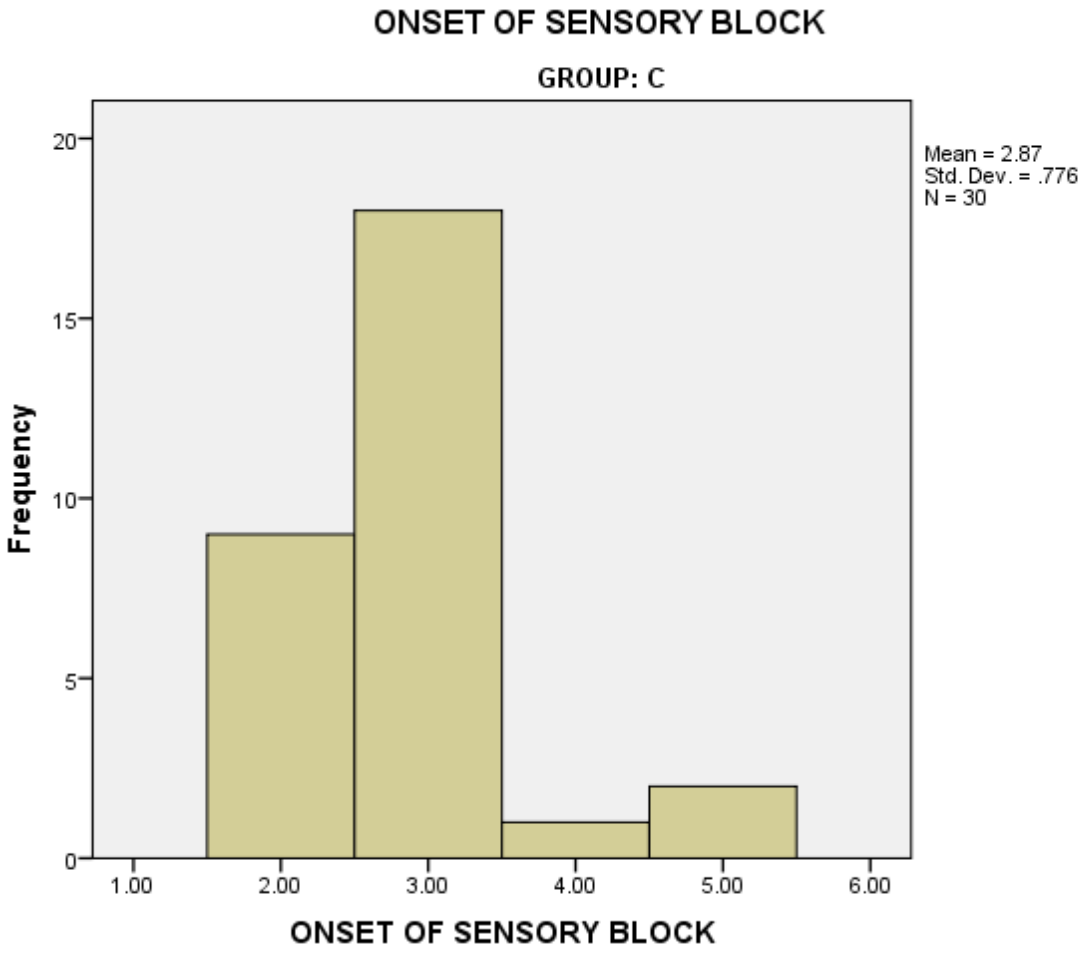
The mean sedation score in group C was 1.00

The mean sedation score in group D was 2.00

These means were statistically significant.

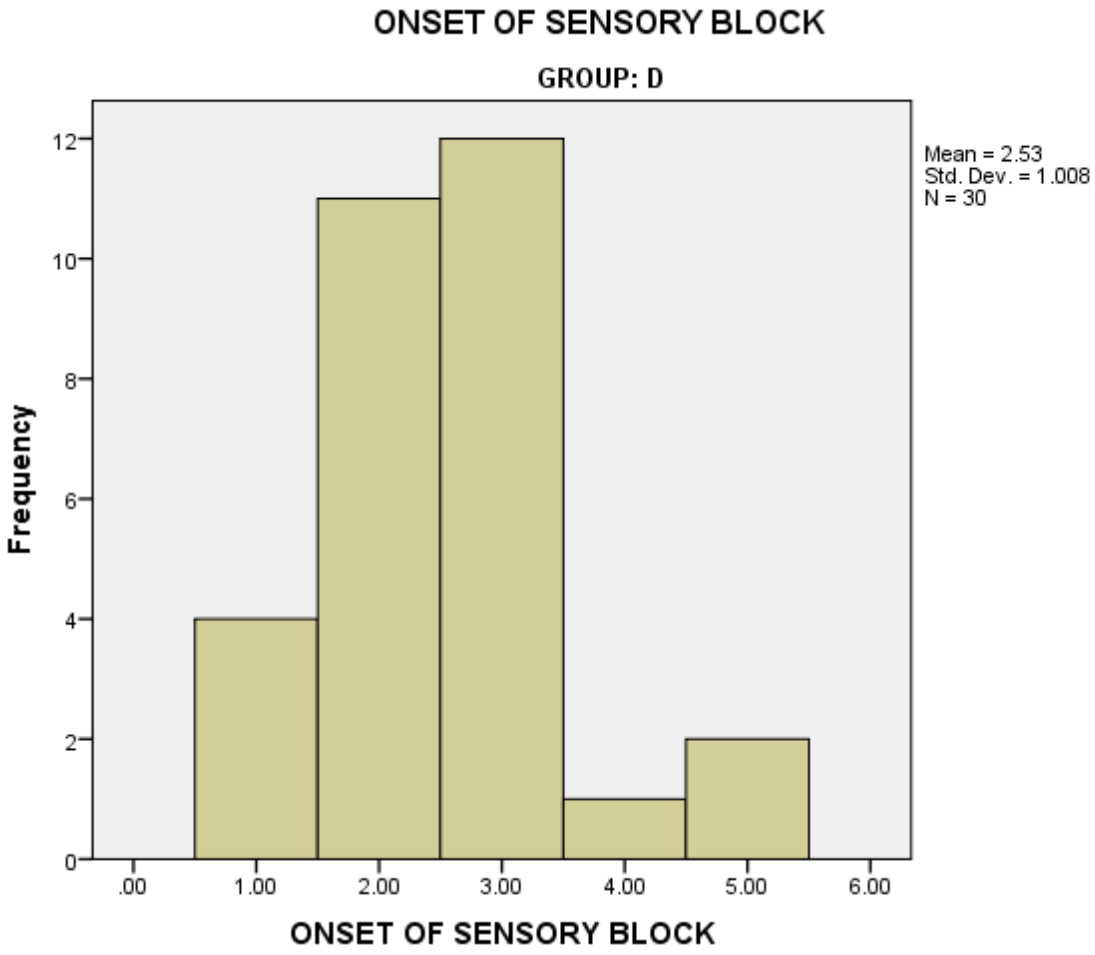
## COMPARISON OF ONSET OF ACTION OF SENSORY BLOCK

Onset of sensory blockade is the time interval between administration of drug and absence of sensation to pin prick (Hollmen's ≥3).



## ONSET OF ACTION OF SENSORY BLOCK IN GROUP D(DEXMEDETOMIDINE WITH BUPIVACAINE)

The time interval between administration of dexmedetomidine with bupivacaine and absence of sensation to pin prick (Hollmen's ≥3) is recorded in minutes as the onset of sensory block



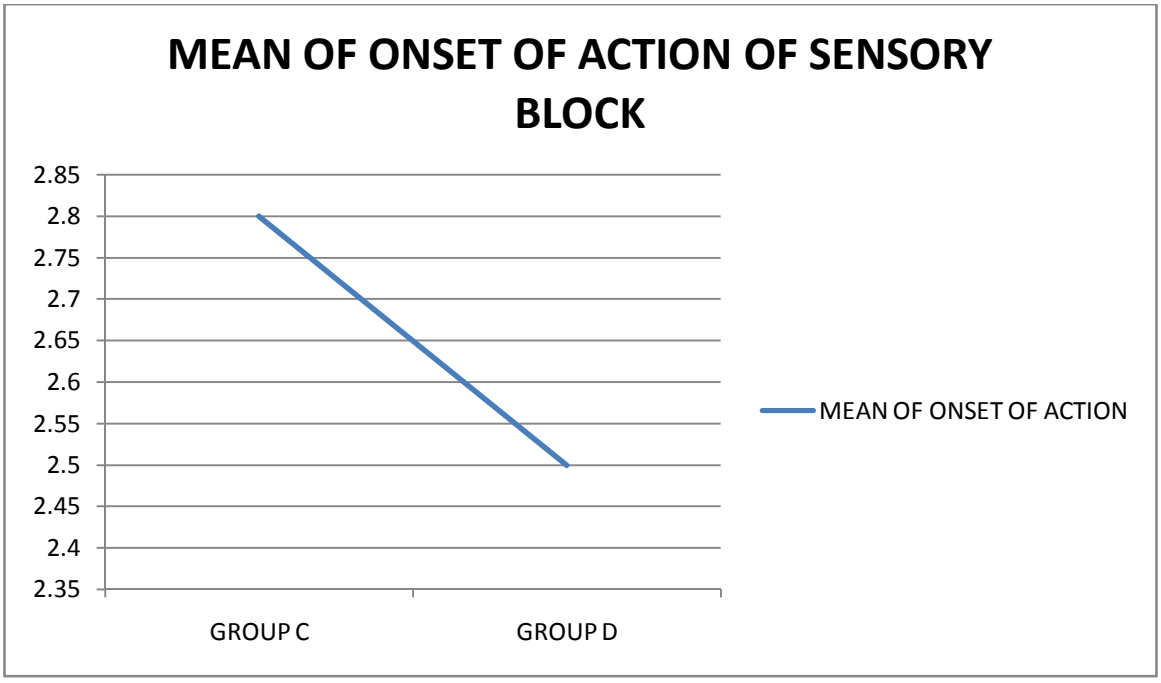
# Comparison of onset of action of sensory block in group C (clonidine with bupivacaine) and group D(dexmedetomidine with bupivacaine)

| GROUP | | N | Mean | | Std. Deviation | 'P' value |
|---|---|---|---|---|---|---|
| | | Statistic | Statistic | Std. Error | Statistic | |
| C | ONSET OF SENSORY BLOCK | 30 | 2.8667 | .14169 | .77608 | |
| | Valid N (listwise) | 30 | | | | 0.14 |
| D | ONSET OF SENSORY BLOCK | 30 | 2.5333 | .18404 | 1.00801 | |
| | Valid N (listwise) | 30 | | | | |

.

This table shows that the onset time of sensory blockade in group D is lesser than that of group C.On statistical analysis, this difference was found to be insignificant

Mean duration of onset of action of sensory block in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine) is drawn as follows:



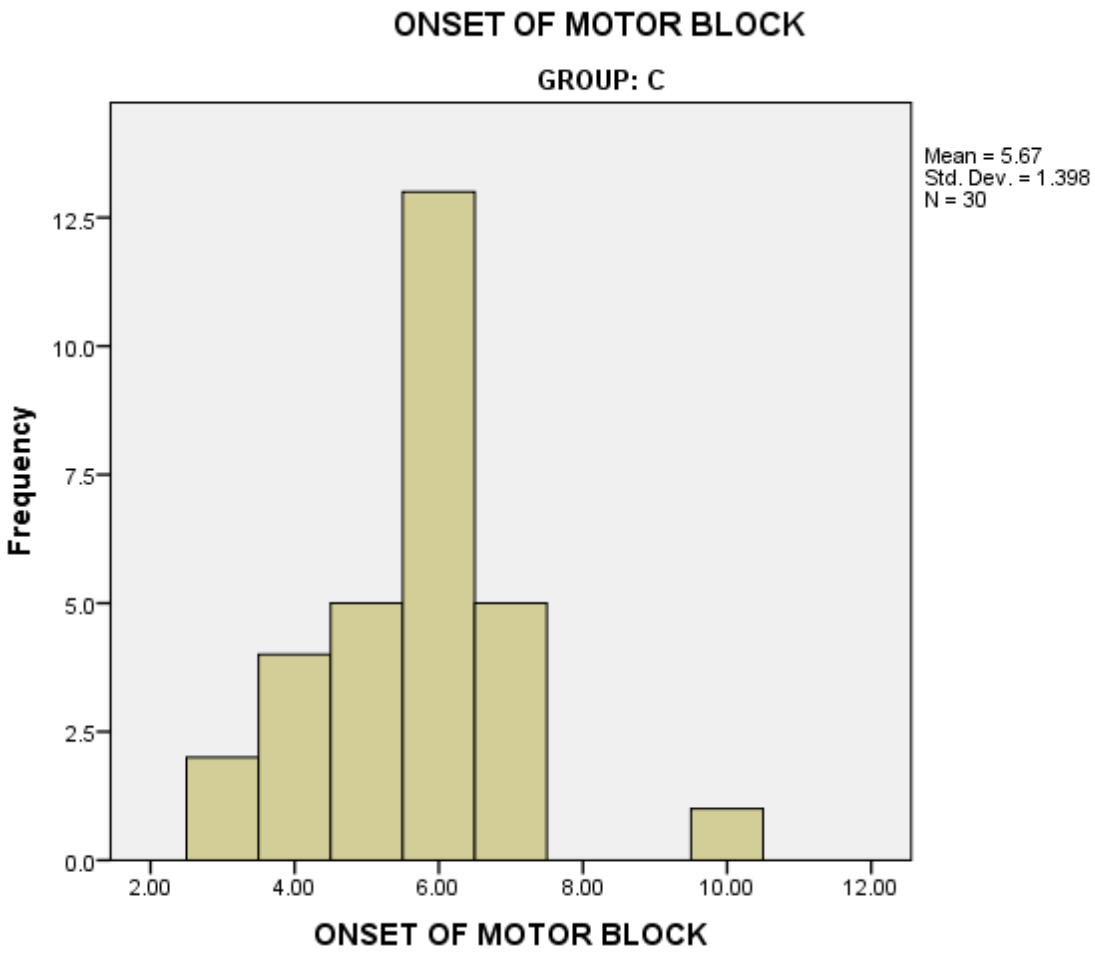
**COMPARISON OF ONSET OF ACTION OF MOTOR BLOCK**

| GROUP | | N | Mean | | Std. Deviation | 'P' value |
|---|---|---|---|---|---|---|
| | | Statistic | Statistic | Std. Error | Statistic | |
| C | ONSET OF MOTOR BLOCK | 30 | 5.6667 | .25521 | 1.39786 | |
| | Valid N (listwise) | 30 | | | | 0.000 |
| D | ONSET OF MOTOR BLOCK | 30 | 5.4667 | .34486 | 1.88887 | |
| | Valid N (listwise) | 30 | | | | |

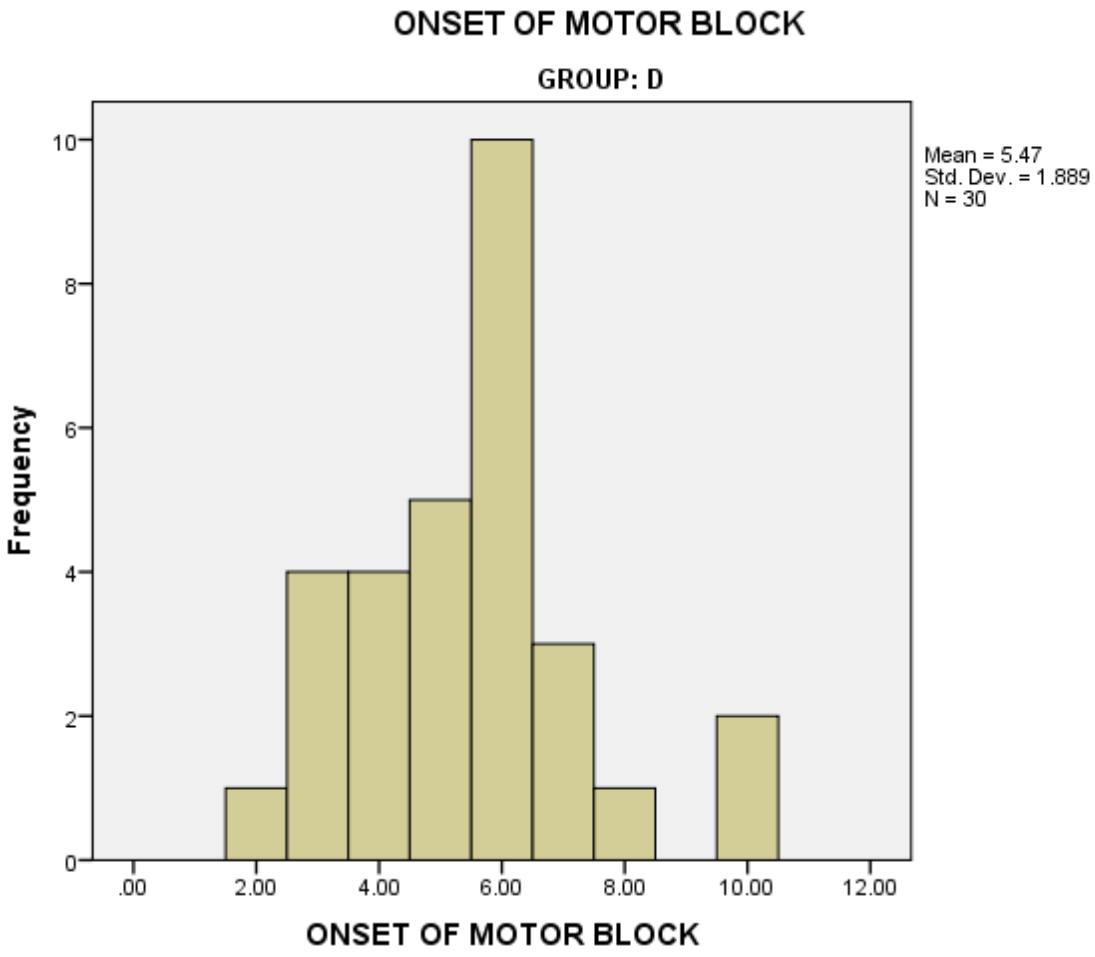
This table compares the onset of motor blockade in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine).

This table shows that the onset time of sensory blockade in group D is lesser than that of group C. On statistical analysis, this difference was found to be significant

Onset of motor blockade in group C(clonidine with bupivacaine) was the time interval between administration of drug and complete loss of muscle function (Hollmen's ≥3) was plotted in minutes as follows:

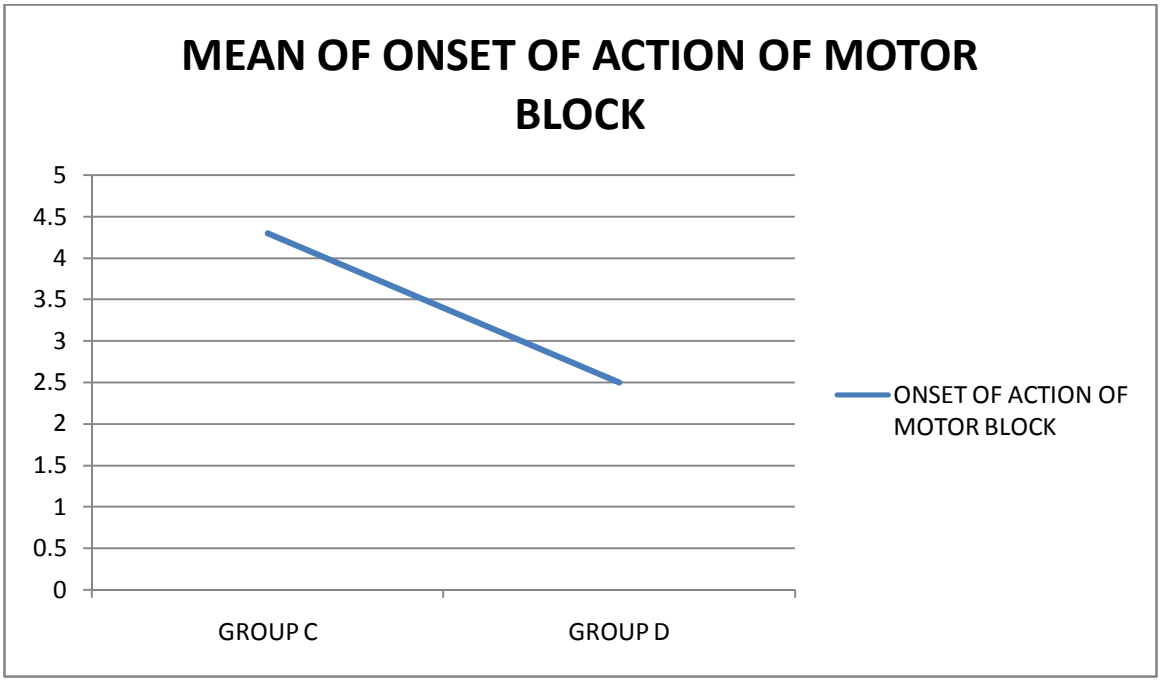


Onset of motor blockade groupD(dexmedetomidine with bupivacaine) was time interval between administration of drug and complete loss of muscle function (Hollmen's ≥3) was plotted in minutes as follows:

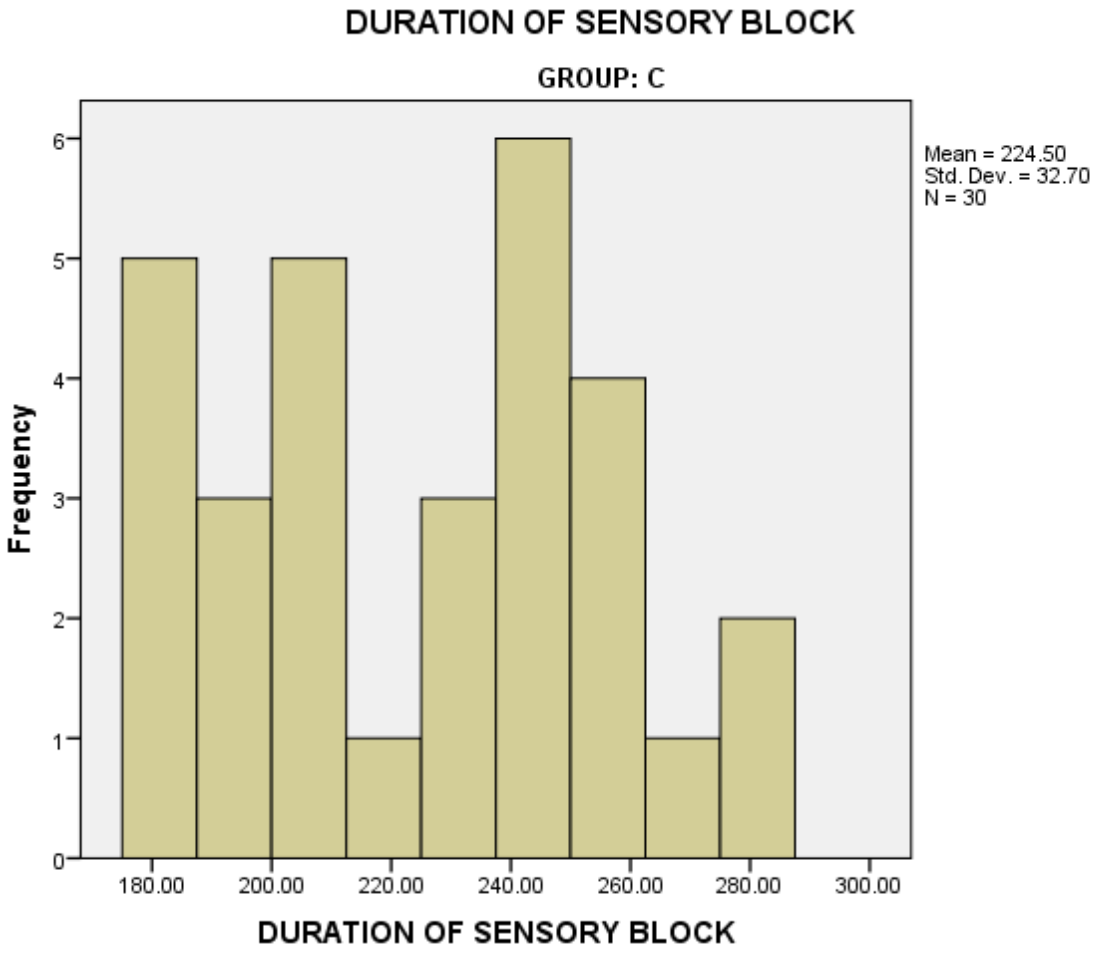


## MEAN OF ONSET OF ACTION OF MOTOR BLOCK

Mean duration of onset of action of motor block in group C(clonidine with bupivacaine) was compared with group D(dexmedetomidine with bupivacaine) as follows:



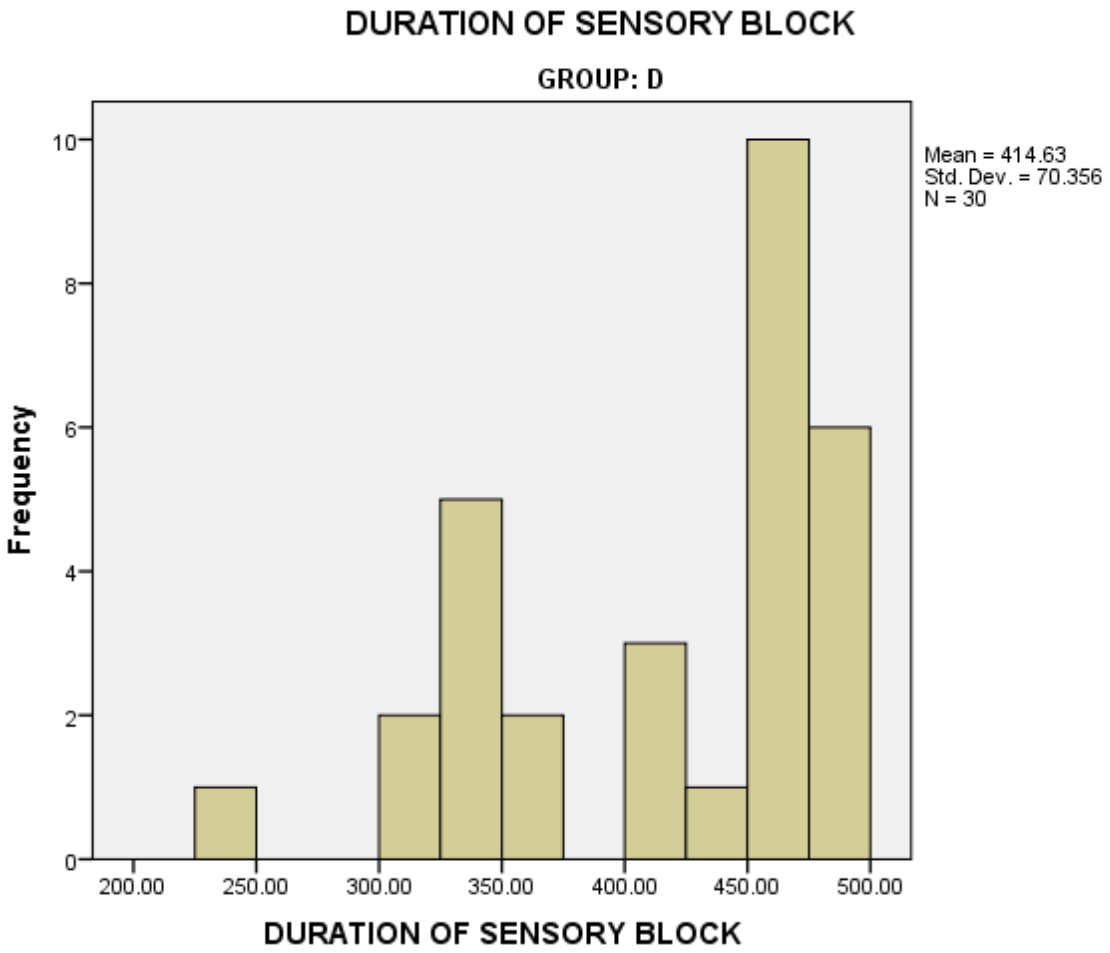
**COMPARISON OF DURATION OF ACTION OF SENSORY BLOCK IN GROUP C (CLONIDINE WITH BUPIVACAINE) AND GROUP D(DEXMEDETOMIDINE WITH BUPIVACAINE)**




Duration of sensory blockade recorded as time interval between onset of complete sensory block and the onset of pain in the post operative period in group C (clonidine with bupivacaine)

# DURATION OF SENSORY BLOCK IN GROUP D

Duration of sensory blockade recorded as time interval between onset of complete sensory block and the onset of pain in the post operative period in group D(dexmedetomidine with bupivacaine)



## COMPARISON OF DURATION OF SENSORY BLOCKADE

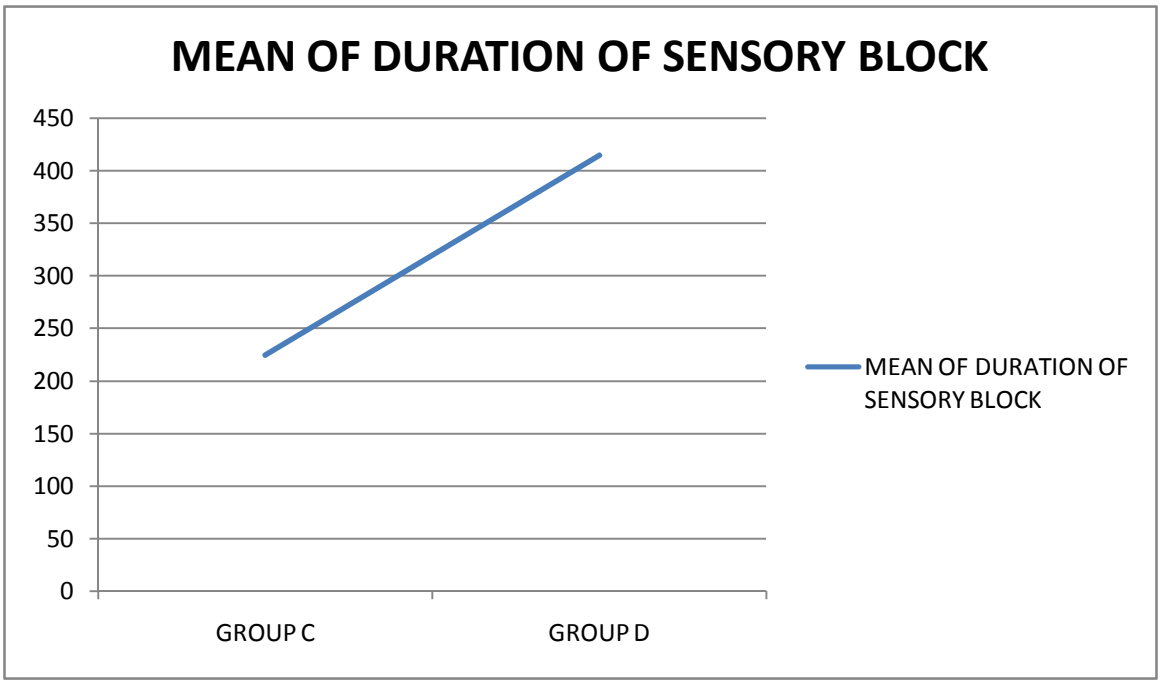
| GROUP | | N | Mean | | Std. Deviation | 'P' value |
|---|---|---|---|---|---|---|
| | | Statistic | Statistic | Std. Error | Statistic | |
| C | DURATION OF SENSORY BLOCK | 30 | 224.5000 | 5.97018 | 32.70005 | |
| | Valid N (listwise) | 30 | | | | 0.000 |
| D | DURATION OF SENSORY BLOCK | 30 | 414.6333 | 12.84519 | 70.35598 | |
| | Valid N (listwise) | 30 | | | | |

This table compares the duration of sensory blockade in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine) .

This table shows that the duration time of sensory blockade in group D is greater than that of group C. On statistical analysis, this difference was found to be significant

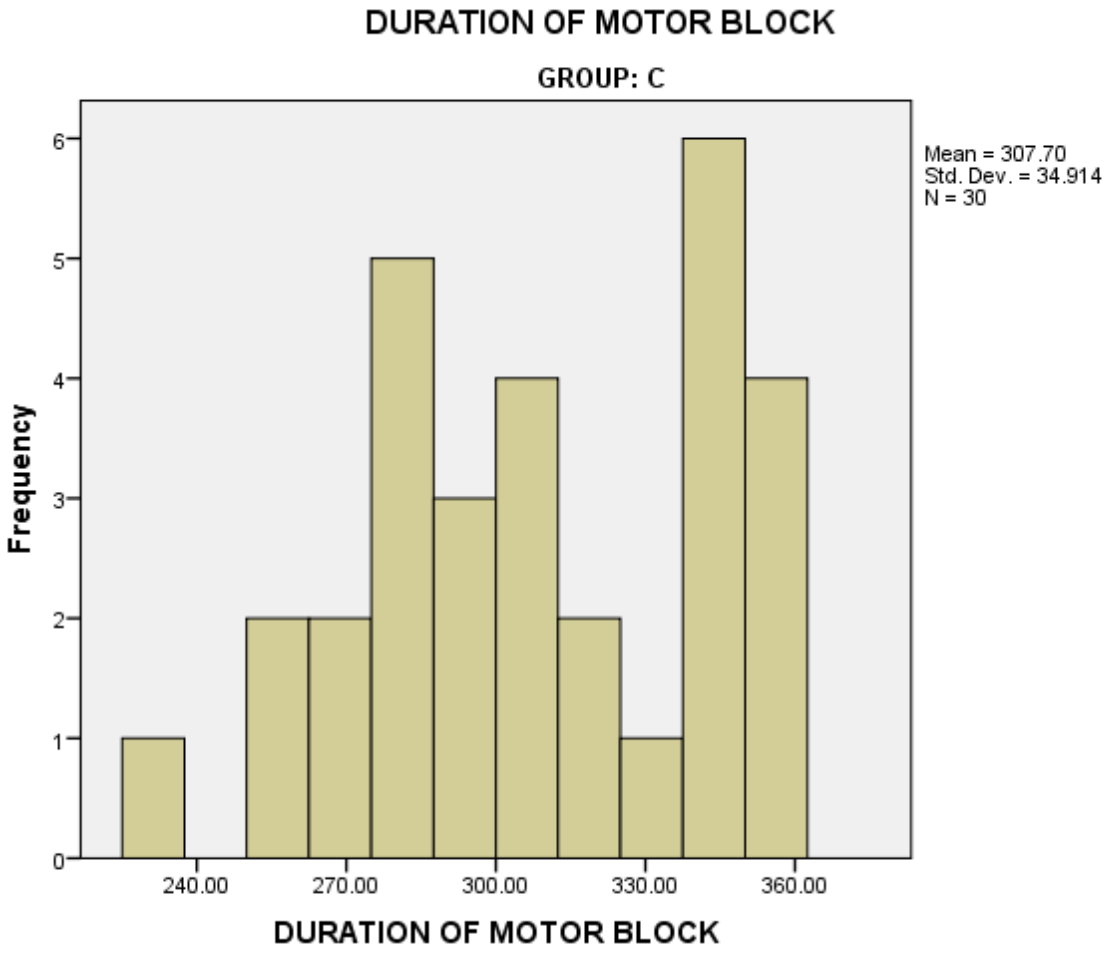
# MEAN DURATION OF SENSORY BLOCK

Mean duration of action of sensory block in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine) is drawn as follows:



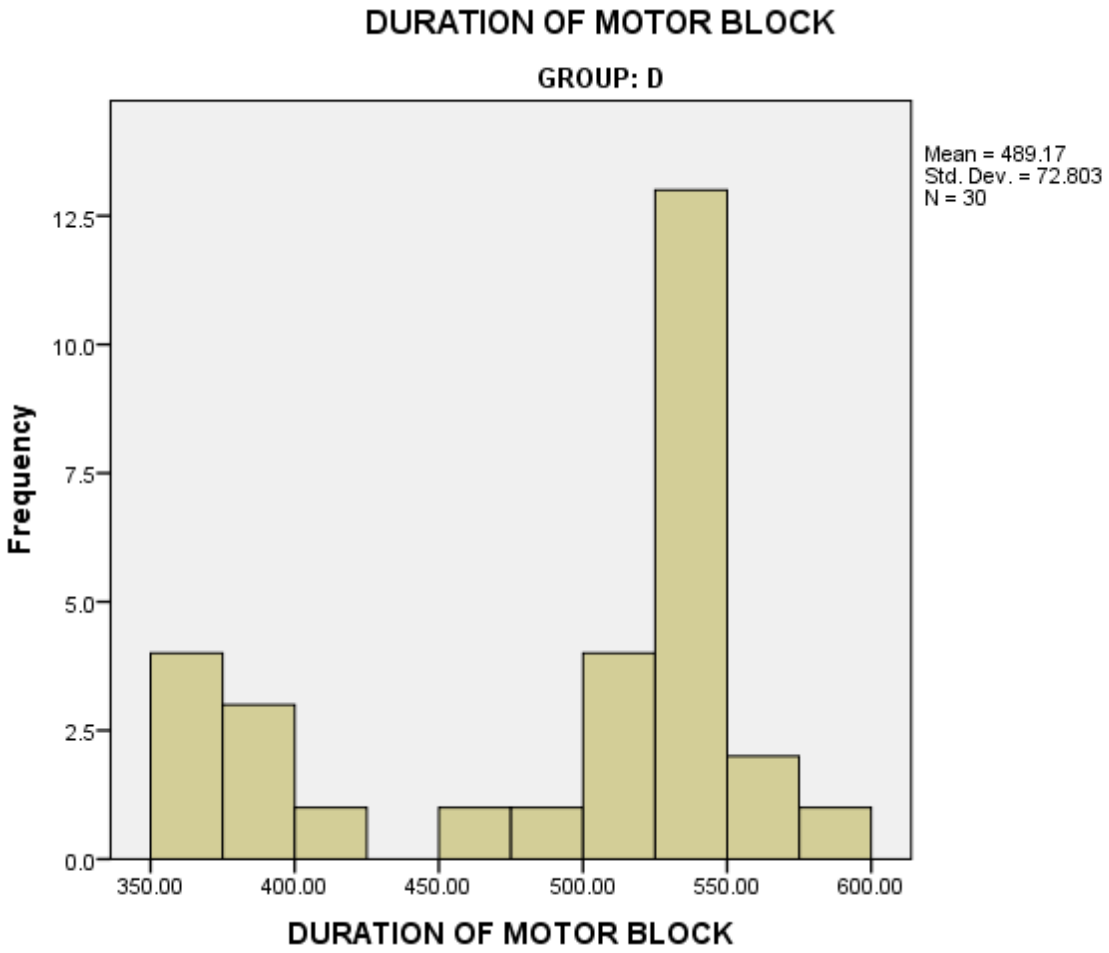
**COMPARISON OF DURATION OF ACTION OF MOTOR BLOCK**

Time interval between onset of complete motor block and the recovery of normal muscle power was recorded in group C(clonidine with bupivacaine) as follows:



## DURATION OF MOTOR BLOCK IN GROUP D

Time interval between onset of complete motor block and the recovery of normal muscle power was recorded in group D(dexmedetomidine with bupivacaine) as follows:



**COMPARISON OF DURATION OF ACTION OF MOTOR BLOCK IN GROUP C (CLONIDINE WITH BUPIVACAINE) AND GROUP D(DEXMEDETOMIDINE WITH BUPIVACAINE)**

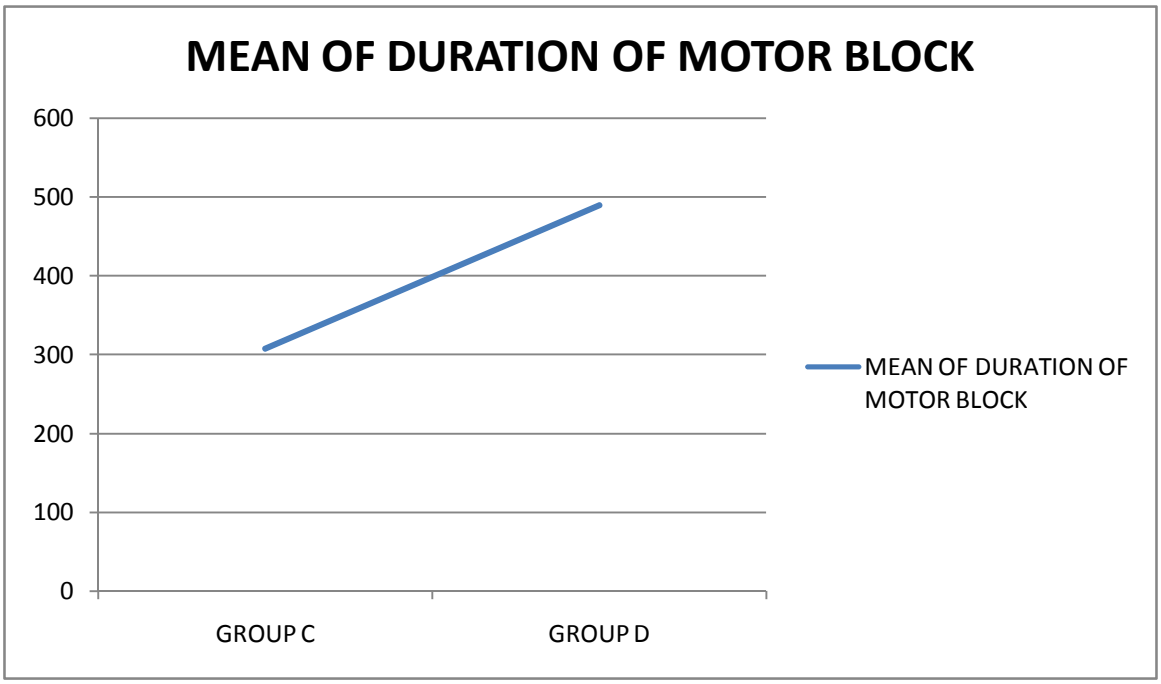
| GROUP | | N | Mean | | Std. Deviation | 'P' value |
|---|---|---|---|---|---|---|
| | | Statistic | Statistic | Std. Error | Statistic | |
| C | DURATION OF MOTOR BLOCK | 30 | 307.7000 | 6.37436 | 34.91383 | |
| | Valid N (listwise) | 30 | | | | 0.000 |
| D | DURATION OF MOTOR BLOCK | 30 | 489.1667 | 13.29195 | 72.80303 | |
| | Valid N (listwise) | 30 | | | | |

This table compares the duration of motor blockade in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine) .

This table shows that the duration time of motor blockade in group D is greater than that of group C. On statistical analysis, this difference was found to be significant

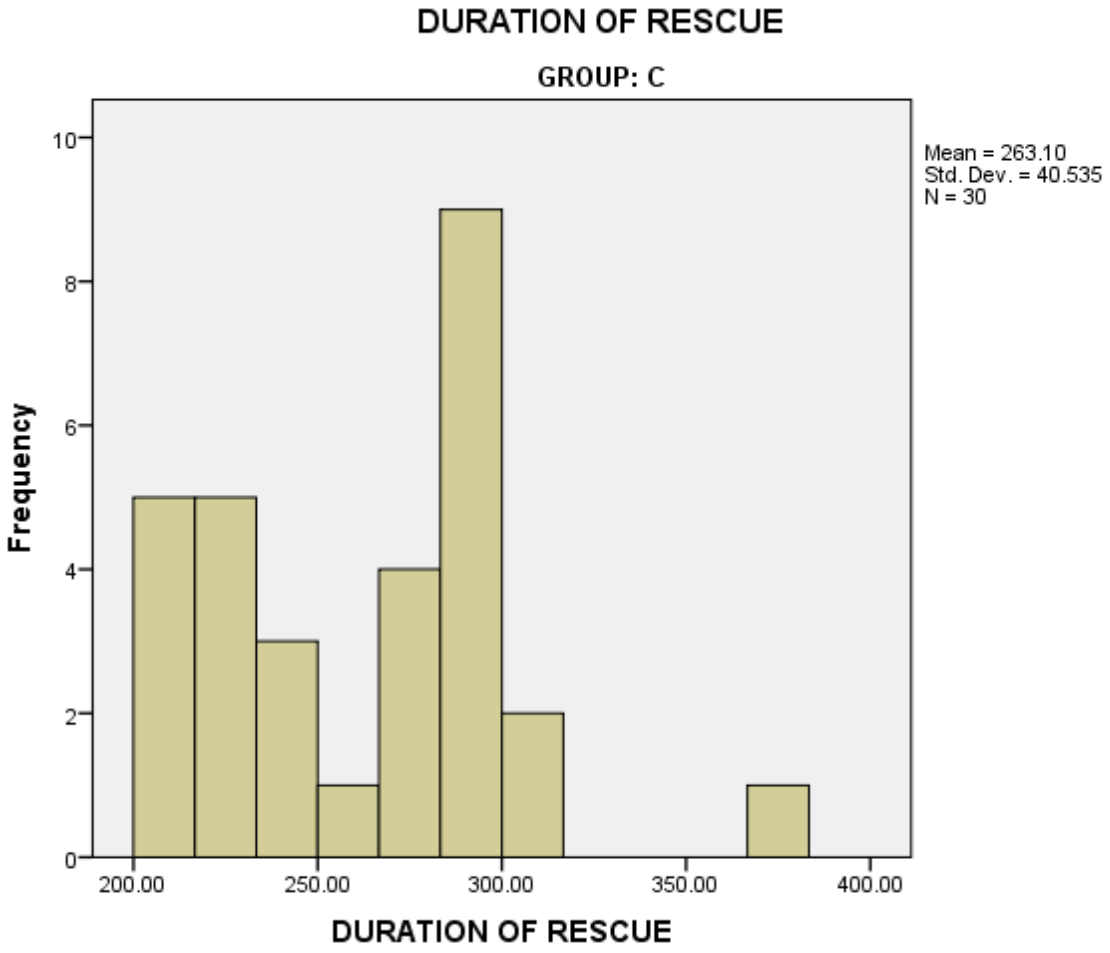
## MEAN DURATION OF MOTOR BLOCK

Mean duration of action of motor block in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine) is drawn as follows:



# DURATION OF RESCUE ANALGESIA

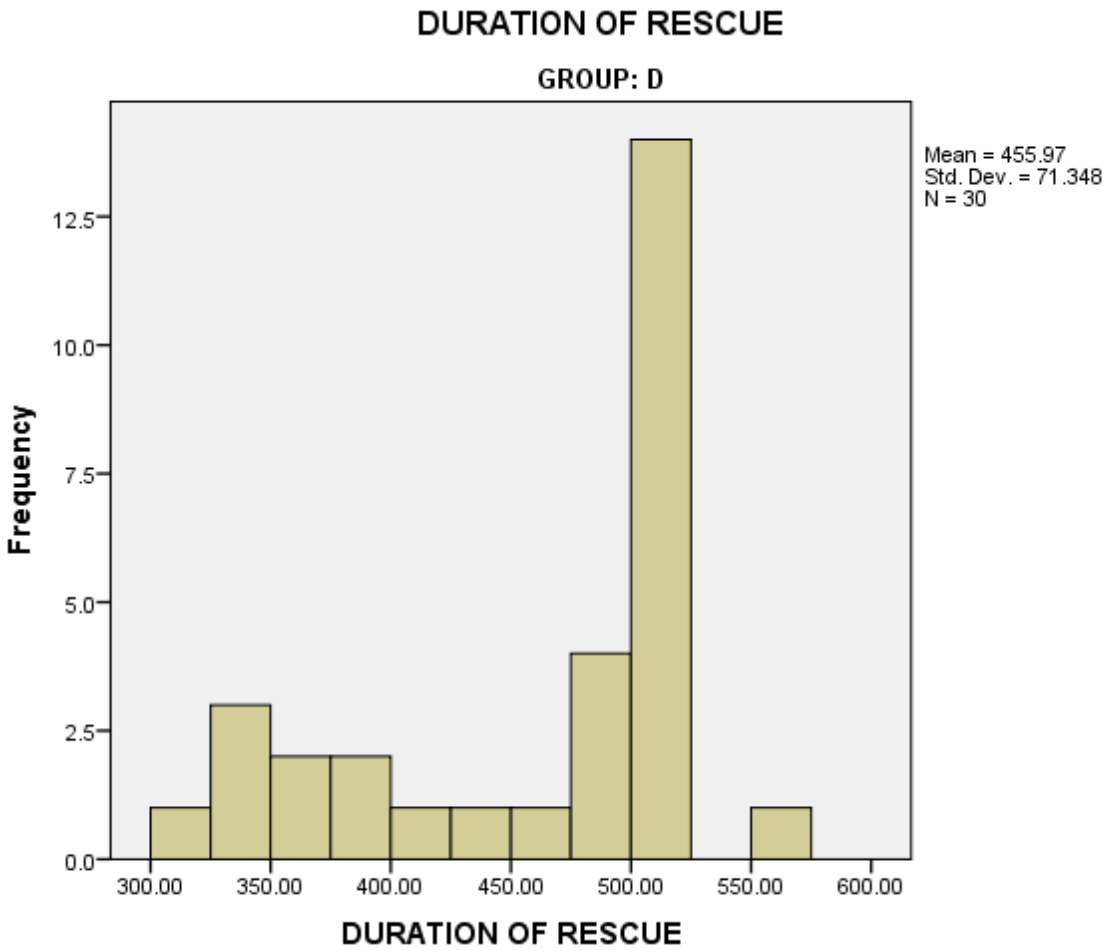
Duration of rescue analgesia as recorded when the patient complains of pain in the postoperative period for the first time; plotted in group C(clonidine with bupivacaine)




**DURATION FOR RESCUE ANALGESIA IN GROUP C**

## DURATION OF RESCUE ANALGESIA IN GROUP D

Duration of rescue analgesia as recorded when the patient complains of pain in the postoperative period for the first time; plotted in group D(dexmedetomidine with bupivacaine)



**COMPARISON OF DURATION FOR RESCUE ANALGESIA IN GROUP C(CLONIDINE WITH BUPIVACAINE) WITH GROUP D (DEXMEDETOMIDINE WITH BUPIVACAINE)**

## Descriptive Statistics

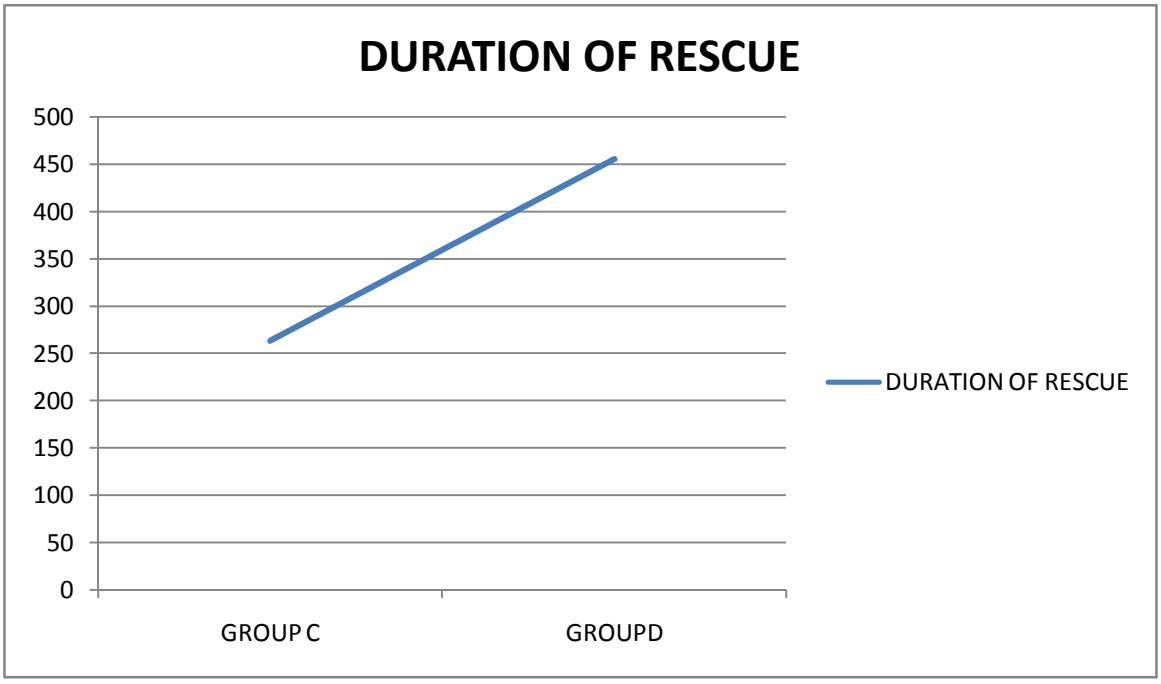
| GROUP | | N | Mean | | Std. Deviation | 'P' value |
|---|---|---|---|---|---|---|
| | | Statistic | Statistic | Std. Error | Statistic | |
| C | DURATION OF RESCUE | 30 | 263.1000 | 7.40058 | 40.53466 | |
| | Valid N (listwise) | 30 | | | | 0.00 |
| D | DURATION OF RESCUE | 30 | 455.9667 | 13.02628 | 71.34785 | |
| | Valid N (listwise) | 30 | | | | |

This table compares the duration for rescue analgesia in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine) .

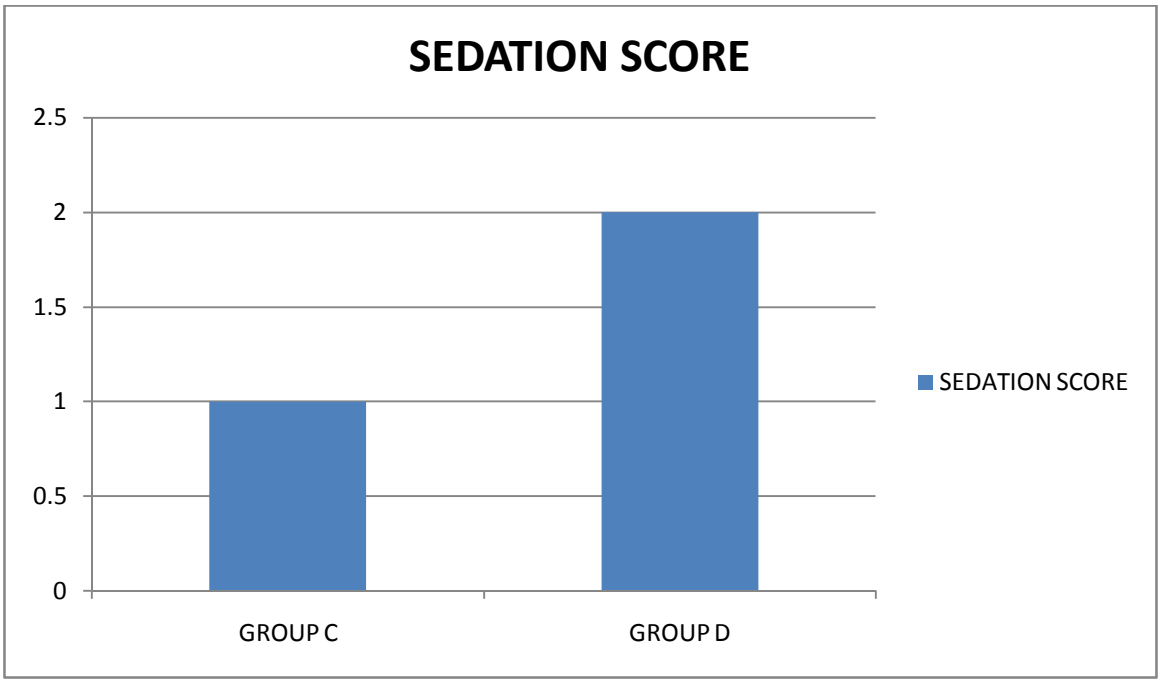
This table shows that the duration for rescue analgesia in group D is greater than that of group C. On statistical analysis, this difference was found to be significant

## MEAN DURATION FOR RESCUE ANALGESIA

Mean duration for rescue analgesia in group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine) drawn as follows:



# SEDATION SCORE




Sedation score as compared between group C(clonidine with bupivacaine) compared with group D(dexmedetomidine with bupivacaine)

Mean sedation score in Group C was 1

Mean sedation score in Group D was 2

This difference was statistically significant.(P value < 0.005)

# DISCUSSION

The demonstration of α2 receptors in the peripheral nervous system prompted recent trials on the usage of α2 rece[ptor agonists,like clonidine and dexmedetomidine combined with bupivacaine for brachial plexus block for upper limb surgeries.Several studies have shown that addition of these adjuvants produce a longer duration of post operative analgesia.

The data was compiled and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS), version 15. Duration of sensory and motor block, and haemodynamic parameters were subjected to Independent t-test for statistical analysis. P-value < 0.05 was considered as statistically significant and P < 0.001 as highly significant

The mean age(in years) of the patients in group C(clonidine with bupivacaine) was 33.33±14.55.The mean age of patients in group D(dexmedetomidine with bupivacaine) was 29.13±12.59. The mean age of both the groups were comparable.

Male to female in group C was 53/47 and in group D was 60/40, which were comparable. Duration of surgery in group C was 92.50±12.78 and in group D was 95.16±11.48 both were demographically comparable.

**DOSAGE OF ALPHA AGONIST:**

In the study of Eledjam JJ et al [28]clonidine 150µg was added to 40 ml of 0.25% bupivacaine to find the efficacy of α2 agonist on brachial plexus block. Swamy et al added 1µg/kg of either clonidine or dexmedetomidine to bupivacaine 0.25% (35 cc) to compare their efficacy on supraclavicular brachial plexus block study[27]. Rao et al added 1µg/kg of either clonidine or dexmedetomidine to bupivacaine 0.25% (38 cc) to compare their efficacy on supraclavicular brachial plexus block. Therefore we decided to use 1 µg/kg of clonidine or dexmedetomidine added to 38 ml of 0.25% bupivacaine to compare their efficacy on brachial plexus block.

**ONSET OF SENSORY BLOCK:**

Onset of sensory block in group C was 2.86±0.77 minutes .Onset of sensory block in group D was 2.53±1.0 minutes. Onset of sensory block in group D is faster than group D but this difference was not statistically significant. This reduction in onset time of sensory blockade correlates with the study by Swamy et al(2012) and Rao et al(2014)

**ONSET OF MOTOR BLOCK:**

Onset of motor block in group C was 5.66 ±1.39 minutes .Onset of motor block in group D was 5.66±1.48 minutes. Onset of motor block in group D is faster than group D; this difference was statistically significant. 'p' value < 0.005.This reduction in onset time of motor blockade correlates with the study done by Swamy et al(2012)[27], Rao et al(2014) , Saurabh Singh et al (2014)

**DURATION OF SENSORY BLOCKADE:**

Duration of sensory blockade in group C was 224.50±32.70 minutes.Duration of sensory blockade in group D was 414.63±70.35 minutes. Duration of sensory blockade in group D was statisitically significant when compared to group C. This corroborates with the study done by Swami et al (2012) (413.97±87.31) and Rao et al(2014) (400.15±85.13minutes)[28]

**DURATION OF MOTOR BLOCKADE:**

Duration of motor blockade in group C w 307.70±34.91 minutes.Duration of motor blockade in group D was 489.16±72.80 minutes. Duration of motor blockade in group D was statistically significant when compared to group C.This corroborates with the study done by Swami et al (2012) (472.24±90.06) and Rao et al(2014) (470±86 minutes)

**HAEMODYNAMIC PARAMETERS:**

In this study, there was no significant change in the haemodynamic baseline in both the groups.This was consistent with the observation by Obayah et al(2010)[25],Swami et al(2012)[27]and Rao et al(2014)[28]

**SIDE EFFECTS:**

None of the patients in the two groups showed any side effects like bradycardia, hypotension, shivering, dry mouth, arrhythmias and local anaesthetic toxicity.

In the study by Swami et al in 2012 none of the patients reported clonidine or dexmedetomidine related side effects when added to bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries.

In another study by Rao et al in 2014[28], no significant side effects like hemodynamic instability and shivering were observed when clonidine or dexmedetomidine was added to bupivacaine in supraclavicular brachial plexus block for upper limb surgeries of moderate duration.This was consistent with the observation byPopping et al[22]and Esmaoglu et al[24].Popping et al added clonidine as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries.Similarly Esmaoglu et al added dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries.No side effects were observed in both these studies.

**SEDATION SCORE:**

The mean sedation score in group C(clonidine with bupivacaine) was 1.0.The mean sedation score in group D(dexmedetomidine with bupivacaine) was 2.0. This difference in sedation score was statistically significant('p' value< 0.005).Sedation is desired in the immediate post operative period. In this regard dexmedetomidine produces better sedation than clonidine when added to bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries of moderate duration(60 to 90 minutes)

**TIME FOR RESCUE ANALGESIA:**

Duration of rescue analgesia as recorded when the patient complains of pain in the postoperative period for the first time; plotted in group D(dexmedetomidine with bupivacaine) was 455.96 ± 71.34 minutes verses group C(clonidine with bupivacaine) was 263.1± 40 minutes.

In the study by Swamy et al(2012),Rao et al(2014) and Saurabh Singh(2014) dexmedetomidine considerably prolonged the time for rescue analgesia when compared to clonidine.This is consistent with our present study where dexmedetomidine proves better than clonidine.

## SUMMARY

We conducted this study at Thanjavur Medical Clooge Hospital in 60 patients of both sexes in the age group of 16 -60 years belonging to ASA I and II and their weight ranging between 40-70 kg, posted for various upper limb surgeries under supraclavicular brachial plexus block.

In clinical studies, adding clonidine or dexmedetomidine to local anaesthetic solutions improved peripheral nerve blocks by quickening the onset time, improving the quality of block during surgery and extending post operative analgesia. Clonidine and dexmedetomidine possibly amplify the Na+ channel blockade action of local anaesthetic by opening up the K+ channels resulting in membrane hyperpolarisation.

This study compares clonidine and dexmedetomidine as an adjuvant to bupivacaine for brachial plexus block by supraclavicular approach for orthopaedic procedures of moderate duration using nerve stimulator. On comparing the efficacy of adding Clonidine as an adjuvant to Bupivacaine as compared to Dexmedetomidine as adjuvant to Bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries, it was found that dexmedetomidine

- Accelerated the onset of sensory and motor blockade.
- Prolonged the duration of motor and sensory blockade.
- Prolonged the time for rescue analgesia in the post-operative period.
- Produced mild to moderate sedation in the post-operative period
- Did not cause any significant haemodynamic changes or adverse effects.

# CONCLUSION

We conclude that addition of 1 µg/kg of dexmedetomidine to 0.25 % bupivacaine accelerates the onset of sensory and motor block, prolongs the duration of sensory and motor block and the time for rescue analgesia with mild sedation without any adverse effects, when compared to clonidine as an adjuvant to bupivacaine in supraclavicular brachial plexus blocks for upper limb surgeries

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## GROUP C (Bupivacaine + Clonidine)

| S. NO | Name | Age | Sex | Wt. | PR (mean) | BP (mean) | Sat. (mean) | Sens. ons. | Mtr. ons. | Drn. sens | Drn. mtr. | Drn. rescue | Sedn. score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Shanmugam | 38 | M | 48 | 72 | 70 | 99 | 2 | 3 | 220 | 300 | 290 | 1 |
| 2. | Jeya | 30 | F | 45 | 76 | 71 | 100 | 2 | 4 | 230 | 290 | 280 | 1 |
| 3. | Karupaiyan | 45 | M | 49 | 71 | 72 | 99 | 2 | 3 | 230 | 310 | 290 | 1 |
| 4. | Sivanathan | 38 | M | 49 | 78 | 81 | 99 | 2 | 6 | 210 | 310 | 220 | 1 |
| 5. | Dinesh | 23 | M | 50 | 81 | 78 | 99 | 2 | 4 | 240 | 340 | 300 | 1 |
| 6. | Hemavathy | 16 | F | 40 | 78 | 68 | 99 | 3 | 6 | 210 | 320 | 290 | 1 |
| 7. | Ranjithkumar | 20 | M | 52 | 82 | 67 | 99 | 3 | 6 | 200 | 230 | 220 | 1 |
| 8. | Valarmathy | 40 | F | 56 | 78 | 78 | 99 | 3 | 7 | 180 | 260 | 210 | 1 |
| 9. | Poominathan | 19 | M | 50 | 76 | 81 | 100 | 2 | 5 | 250 | 340 | 310 | 1 |
| 10. | Chetlaswamy | 18 | M | 42 | 82 | 82 | 99 | 3 | 6 | 260 | 350 | 290 | 1 |
| 11. | Vijendran | 28 | M | 50 | 90 | 83 | 99 | 3 | 7 | 280 | 350 | 310 | 1 |
| 12. | Ananthi | 20 | F | 52 | 77 | 91 | 99 | 2 | 4 | 248 | 298 | 252 | 1 |
| 13. | Vairakannu | 65 | F | 48 | 74 | 101 | 99 | 3 | 7 | 256 | 322 | 272 | 1 |
| 14. | Muthulakshmi | 45 | F | 47 | 82 | 78 | 99 | 3 | 5 | 248 | 348 | 370 | 1 |
| 15. | Sundramoorthy | 46 | M | 49 | 79 | 82 | 99 | 3 | 6 | 247 | 347 | 280 | 1 |
| 16. | Desika | 17 | F | 40 | 81 | 78 | 99 | 3 | 7 | 190 | 280 | 210 | 1 |
| 17. | Dharmaraj | 28 | M | 52 | 78 | 68 | 99 | 3 | 6 | 192 | 280 | 230 | 1 |
| 18. | Manikandan | 19 | M | 55 | 81 | 69 | 100 | 2 | 5 | 200 | 300 | 250 | 1 |
| 19. | Amaravathy | 65 | F | 45 | 69 | 70 | 99 | 3 | 6 | 232 | 280 | 248 | 1 |
| 20. | Kannagi | 25 | F | 65 | 79 | 71 | 99 | 2 | 4 | 178 | 260 | 212 | 1 |
| 21. | Priyanka | 21 | F | 45 | 72 | 68 | 99 | 3 | 6 | 260 | 340 | 290 | 1 |
| 22. | Arivalagan | 48 | M | 45 | 89 | 76 | 99 | 5 | 5 | 248 | 330 | 290 | 1 |
| 23. | Govindaraj | 43 | M | 40 | 91 | 68 | 100 | 3 | 6 | 248 | 338 | 269 | 1 |
| 24. | Vaduvayee | 47 | F | 35 | 89 | 78 | 99 | 4 | 7 | 200 | 280 | 240 | 1 |
| 25. | Rasiga | 17 | F | 48 | 98 | 72 | 99 | 3 | 5 | 180 | 270 | 210 | 1 |
| 26. | Prakash | 27 | M | 59 | 71 | 69 | 99 | 3 | 6 | 180 | 270 | 220 | 1 |
| 27. | Chellapappu | 60 | F | 45 | 72 | 74 | 99 | 3 | 6 | 180 | 278 | 210 | 1 |
| 28. | Shalini | 36 | F | 50 | 75 | 68 | 99 | 3 | 6 | 190 | 290 | 230 | 1 |
| 29. | Thamaraiselvan | 22 | M | 40 | 71 | 69 | 99 | 3 | 6 | 278 | 360 | 300 | 1 |
| 30. | Ravikumar | 34 | M | 45 | 71 | 72 | 100 | 5 | 10 | 270 | 360 | 300 | 1 |

## GROUP D (Bupivacaine +Dexmedetomidine)

| S.NO | Name | Age | Sex | Wt. | PR (mean) | BP (mean) | Sat. | Sens. ons. | Mtr. ons. | Drn. sens | Drn. mtr. | Drn. rescue | Sed. score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Hemalatha | 16 | F | 52 | 78 | 65 | 99 | 2 | 6 | 320 | 400 | 360 | 2 |
| 2. | Azhaguraja | 19 | M | 54 | 82 | 66 | 99 | 3 | 7 | 350 | 450 | 400 | 2 |
| 3. | Rameshkumar | 40 | M | 48 | 81 | 67 | 99 | 1 | 3 | 460 | 500 | 480 | 2 |
| 4. | Saleem | 24 | M | 50 | 76 | 76 | 99 | 3 | 6 | 480 | 540 | 310 | 2 |
| 5. | Murugesan | 40 | M | 50 | 91 | 67 | 99 | 3 | 6 | 460 | 520 | 480 | 2 |
| 6. | Kishorekumar | 17 | M | 48 | 89 | 68 | 99 | 3 | 6 | 485 | 550 | 500 | 2 |
| 7. | Manimegalai | 48 | F | 45 | 78 | 69 | 99 | 2 | 3 | 320 | 350 | 340 | 2 |
| 8. | Vijayabalan | 32 | M | 50 | 89 | 72 | 99 | 3 | 6 | 472 | 538 | 500 | 2 |
| 9. | Pakrudhin | 21 | M | 54 | 72 | 71 | 99 | 3 | 6 | 482 | 541 | 520 | 2 |
| 10. | Ramadoss | 58 | M | 50 | 71 | 69 | 99 | 2 | 4 | 480 | 540 | 510 | 2 |
| 11. | Santhosh | 17 | M | 51 | 71 | 78 | 99 | 1 | 3 | 330 | 360 | 348 | 2 |
| 12. | Parasuraman | 18 | M | 51 | 68 | 71 | 99 | 2 | 4 | 330 | 370 | 340 | 2 |
| 13. | Priyadharsini | 17 | F | 50 | 89 | 66 | 99 | 3 | 6 | 472 | 530 | 512 | 2 |
| 14. | Kavitha | 17 | F | 44 | 91 | 67 | 99 | 3 | 7 | 466 | 538 | 520 | 2 |
| 15. | Divya | 16 | F | 46 | 78 | 68 | 99 | 2 | 4 | 360 | 394 | 378 | 2 |
| 16. | Perumal | 35 | M | 52 | 82 | 69 | 99 | 1 | 2 | 400 | 500 | 450 | 2 |
| 17. | Palanisamy | 16 | M | 42 | 88 | 70 | 100 | 3 | 5 | 478 | 538 | 520 | 2 |
| 18. | Gnanamary | 35 | F | 50 | 77 | 69 | 99 | 2 | 6 | 470 | 530 | 500 | 2 |
| 19. | Manikandan | 27 | M | 60 | 78 | 64 | 99 | 2 | 5 | 246 | 536 | 500 | 2 |
| 20. | Dharmaraj | 28 | M | 48 | 68 | 72 | 99 | 2 | 4 | 420 | 520 | 500 | 2 |
| 21. | Alagudevi | 24 | F | 52 | 69 | 71 | 100 | 3 | 6 | 440 | 590 | 480 | 2 |
| 22. | Chinnaponnu | 51 | F | 55 | 72 | 78 | 99 | 2 | 8 | 450 | 538 | 510 | 2 |
| 23. | Saravanan | 32 | M | 55 | 74 | 76 | 99 | 5 | 10 | 470 | 530 | 500 | 2 |
| 24. | Vijakumar | 30 | M | 50 | 76 | 82 | 98 | 2 | 5 | 460 | 560 | 480 | 2 |
| 25. | Periyanayaki | 55 | F | 40 | 78 | 81 | 99 | 5 | 10 | 326 | 396 | 375 | 2 |
| 26. | Kanniyammal | 32 | F | 54 | 91 | 80 | 99 | 3 | 6 | 470 | 538 | 500 | 2 |
| 27. | Kasthuri | 45 | F | 49 | 68 | 68 | 99 | 4 | 5 | 482 | 542 | 520 | 2 |
| 28. | Ilakkiya | 21 | F | 40 | 72 | 67 | 99 | 3 | 5 | 330 | 396 | 556 | 2 |
| 29. | Sundaresan | 26 | M | 52 | 89 | 76 | 99 | 1 | 3 | 330 | 360 | 350 | 2 |
| 30. | Muthusamy | 17 | M | 48 | 91 | 80 | 99 | 2 | 7 | 400 | 480 | 440 | 2 |

## CONSENT FORM

I _____ hereby give consent to participate in the study conducted by **DR.V.SARAVANAGOPI ,** post graduate in department of Anaesthesiology ,Thanjavur medical college & hospital, Thanjavur and to use my personal clinical data and result of investigation for the purpose of analysis and to study the nature of disease. I also give consent for further investigations

Place :

Date : Signature of participant

## Annexure I

Name : Age/Sex: IP No:

Hospital : Date:

**Preoperative observations**

**General Examination:** **Physical examination:**

Pulse rate: bpm BP: mm of Hg RR: per min Weight: kg

**Systemic examination:**

CVS: RS: Others: **Investigations:**
Hb: % FBS/RBS: ECG:

Blood Urea: Sr.Creatinine: Urine:

Preoperative diagnosis : Proposed surgery :

Premedication : Inj.Ranitidine 50mg and Inj.Ondansetron 8mg

ASA grade : I / II

Anaesthetic technique : Supraclavicular approach to brachial plexus block using nerve stimulator

**Study protocol** : 40 ml of 0.25% Bupivacaine with 100mcg Clonidine or 40 ml of 0.25% Bupivacaine with 100mcg Dexmedetomidine

| **Time of Injection** | | **Onset of sensory blockade** | | **Onset of Motor Blockade** | |
|---|---|---|---|---|---|
| **Duration** | **Pulse rate** | **BP(mm of Hg)** | **SpO2%** | **Sedation score** | |
| 0 min | | | | | |
| 5 min | | | | | |
| 10 min | | | | | |
| 15 min | | | | | |
| 30 min | | | | | |
| 60 min | | | | | |
| 2hrs | | | | | |
| 6hrs | | | | | |
| 12hrs | | | | | |
| 24hrs | | | | | |
| Duration of sensory blockade | | Duration of Motor blockade | | Time &No. of rescue analgesics in post-op 24hrs | |